IITA 1997 Annual Report

NASA Communicating Science

Information Infrastructure Technology and Applications Project

High Performance Computing and Communications Program

September 30, 1997

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NASA Communicating Science

IITA 1997 Annual Report

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NASA Communicating Science
IITA 1997 Annual Report

The IITA 1997 Annual Report is a compilation of the highlights and accomplishments of the fifty-one grants, cooperative agreements, and in-house efforts supported by NASA's Information Infrastructure Technology and Applications (IITA) project.

Goal of the IITA

Accelerate the creation of a national information infrastructure.

Approach

Demonstrate application of newly emerging communication technologies by bringing NASA information to schools and the public.

Status

The IITA project consists of fifty-one grants, cooperative agreements, and in-house efforts in three key areas:

- Public Use of Remote Sensing Data
- Development of Digital Library Technology
- K-12 Education Over the Internet

Each of these areas supports the development of new technologies to facilitate broader access to NASA data via computer networks.

As of September 30, 1997, the NASA IITA project has concluded. The associated Web site (http://iita.ivv.nasa.gov/) will now serve as an archive for the products that were developed as part of IITA.

A closely related NASA initiative, the **Learning Technologies Project** (**LTP**), will continue to focus on Internet and information technologies that improve science and technology education in the United States. LTP teaches young and old about NASA exploration and discoveries throughout our world and universe.

The LTP Web site may be viewed at http://learn.ivv.nasa.gov.

Point of Contact for the NASA IITA Project

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An online version of this report is available at http://iita.ivv.nasa.gov/program/iita1997/

IITA 1997 Annual Report

http://iita.ivv.nasa.gov/

Part of NASA's High Performance Computing and Communications Program

Objective

- **Communicating Science**. We seek to demonstrate how newly emerging communication technologies can be used to bring NASA's science and engineering data to schools and the public.

Approach

- **Digital Libraries**. Develop innovative technologies for digital libraries that make NASA data more easily accessible.
- **Public Access**. Provide public access to national science data assets, including space observations of the Earth, our solar system, and the universe beyond.
- **Educational Resources**. Develop educational resources for schools and the public about aeronautics, astronomy, the Earth, and space exploration.

Significance

- In 1994, IITA projects were among the first to use the World Wide Web.
- Extensive amounts of NASA information were made available to the public.

Point of Contact

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Accomplishments

- IITA's Web servers sustained a rate of over 350,000 accesses per day.
- The IITA Project Office received the Intergovernmental Open Systems Solutions (IOSS) award for a Distance Learning Course.
- IITA projects received over seventy awards from independent rating services. Some of these projects are:
  - Earth System Science Community
  - Exploring the Environment
  - NASA's Jet Propulsion Laboratory's Telescopes In Education
  - NASA's Langley Research Center's K-12 Initiative
  - NASA's Observatorium (RSPAC Web site)
  - Passport to Knowledge
  - PlaneMath
  - Public Use of Remote Sensing Data Project Office
  - Quest - Ames Research Center's K-12 Internet Initiative
  - Virtually Hawaii
  - VolcanoWorld
  - Windows to the Universe
- The "NASA IITA Product Guide" was published and distributed to industry, academia, and other government agencies.
- Two thousand NASA Educator Kits containing IITA educational material were distributed to schools.
- Over 200 papers were published by the Digital Library Technology/Digital Library Initiative projects.
- Collaborated with and provided support to 5,318 schools.
- Presented an international paper on learning over the Internet at the INET '97 conference held in Kuala Lumpur, Malaysia.

This was the last year of the IITA project.

Post-1997 activities have been transferred to other NASA programs. In particular, **NASA's Learning Technologies Project (LTP)** will continue to focus on Internet and information technologies that improve science and technology education in the United States. More information on LTP may be found at http://learn.ivv.nasa.gov.

Public Use Of Remote Sensing Data

Objective

Demonstrate innovative public and commercial applications of NASA's remote sensing data assets.

Approach

Initiate collaborative projects with academia and industry to advance applications of remote sensing data.

NASA currently maintains twenty-one cooperative agreements and grants in educational, land management, and public interest applications of remote sensing data.

Point of Contact for Remote Sensing Projects

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Fax: (301) 286-1762
URL: http://rsd.gsfc.nasa.gov/rsd/

Educational Applications of Remote Sensing Data

Grades K-6

Everyday Classroom Tools - Smithsonian Astrophysical Observatory

Friendly Internet Front End (FIFE) for Grades K-6 - The Analytic Sciences Corporation

Grades K-12

Athena: Curriculum Development, Implementation, and Support on the Internet - Science Applications International Corporation

Exploring the Environment - Classroom of the Future

Live From Earth and Mars: Atmospheric and Space Sciences Data for K-12 - University of Washington

Passport to Knowledge: Electronic Field Trips to Scientific Frontiers via Interactive TV and the Internet - The Childhood Project

Science Information Infrastructure: Access to Earth and Space Science Data through Museums - University of California at Berkeley

Space Available - Gulf of Maine Aquarium

Virtually Hawaii - University of Hawaii

VolcanoWorld - University of North Dakota

WeatherNet4 - WRC-TV

Windows to the Universe - University of Michigan

Yohkoh Public Outreach Project: Seeing the Sun in X-rays - Lockheed Palo Alto Research Laboratory

Grades 10-12+

The Earth System Science Community - ECOlogic/Gonzaga High School

Emergency and Crisis Management - University of North Texas

Using Science and the Internet as Everyday Classroom Tools

http://hea-www.harvard.edu/ECT/

Objective/Approach

- **Smithsonian Astrophysical Observatory** is working with elementary schools in Massachusetts to develop an integrated, inquiry-inspiring curriculum framework that brings science and the Internet into the everyday life of the elementary classroom.
- Our goal is to infuse the **Spirit of Inquiry** into every school subject, so that students and teachers can approach learning as a lifelong exploration of the world around us.

Significance

- **Teachers** become comfortable and proficient at teaching inquiry-based science.
- **Teachers** learn to connect inquiry-based teaching methods and activities with other subjects in order to integrate the school day.
- **Students** learn to approach science and inquiry as a natural way of investigating the world around us.

Accomplishments

- Conducted more than 100 workshops and sessions to train teachers in science, technology, and the **Spirit of Inquiry**.
- Redesigned our online teacher's manual, **The Spirit of Inquiry Threads of Investigation**, to reflect lessons learned from our ongoing work in schools.
- Developed a companion manual, **Inquiry in the Classroom**, to support teachers who are new to inquiry techniques.
- Expanded our **Spirit of Inquiry** theme to support elementary schools "at a distance."
- Refined our scheme for providing Internet access to elementary schools through **research/education technology partnerships.**

Plans

- Disseminate the **Threads of Investigation** to schools and educational organizations nationwide (through the Internet, hard copy, and CD-ROM).

Point of Contact

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FIFE: Friendly Internet Front End (FIFE) for Grades K-6

The Internet Weather Explorer
http://fife.ivv.nasa.gov

Objective

To create a flexible system to allow educators, students, and parents to use NASA-derived weather images and data as part of elementary school science curricula.

Approach

Develop a low-cost, multimode, multiuser system that can be run on common school hardware and software or over the WWW. Multimedia lessons are available for immediate use by teachers and students at the Web site for playback inside the Netscape Navigator browser, or for download to Macintosh or Windows. Also, teachers can choose to create powerful multimedia lessons themselves. These lessons are automatically posted to the WWW for use by students and other educators.

Significance

This project is one of the few that support education at the lower grade levels. It also has a uniquely strong focus on providing teachers with the means to develop their own lessons using resources available over the Internet, rather than providing them with pre-compiled material.

Accomplishments

Developed tools for teachers for authoring lessons that may be played back from stand-alone computers or within a WWW browser window. Tools range from a simple WWW page editor with links to pre-built multimedia applets to a multimedia applet builder itself. All tools are available free from the WWW site. The site also supports an online discussion board.

NASA-derived data have been used in an elementary school environment by over sixty students at Franconia Elementary School (FES) in Alexandria, VA. Educators have created lesson plans suitable for both in-school (LAN) and national distribution (via WWW).

Plans

Current capabilities are being expanded. Addition of an integrated lesson planner and student response form are planned. Also, capability for automatic uploads of lessons by educators is being added. Online training lessons with animations and audio will be created for the site. While this agreement was to expire in Fiscal Year 1997, it is being extended at no cost to the government to allow the project to continue until January 1998.

Point of Contact

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Athena
Earth and Space Science for K-12

http://athena.wednet.edu/
http://inspire.ospi.wednet.edu:8001/
http://www.athena.ivv.nasa.gov/

Objective

To enhance existing science curricula by delivering instructional materials to K-12 students via the WWW.

Approach

A three-year project of ***SAIC*** with partner educators to write classroom materials and train teachers. Students use real data sets supported by content explanations, student activities, and additional information for teachers. The materials foster constructivist learning and are linked to state learning standards.

Accomplishments

Over 100 activities with supporting content and related links.

Twenty teachers in four Washington State school districts piloted **Athena** during the 1995-96 school year, with expanding use in 1996-97. Teachers trained and wrote new material during workshops in the summers of 1996 and 1997.

Accessed from sites nationally and internationally.

Positive feedback from teachers, students, and parents:

- "The most comprehensive and impressive resource I have seen."
- "This was an extremely valuable addition to our science education this year."
- "The real-time data (have) prompted awesome discussions and real questions from my students."
- "I am a 7th grade student delighted to find this GREAT Web page."

Significance

Students are exposed to real science and current data. **Athena** increases student awareness of science and science careers.

Plans

SAIC will curate the present Web sites through the 1997-98 school year, adding new material as it becomes available.

The present agreement expires in Fiscal Year 1997, but the project will be extended and RSPAC will continue to host materials.

Point of Contact

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Fax: (425) 485-5566

Exploring the Environment

http://www.cotf.edu/ete

Objective

To engage students in authentic, real-world problems and facilitate cognitive growth in content and research processes.

Approach

Provide students with tools to investigate scientific, social, political, and cultural aspects of controversial, authentic, environmental problems within an interdisciplinary framework and then generate possible solutions.

Develop student-directed inquiry problem-solving guides, problem-specific background materials, links to other resources via the World Wide Web (WWW), and access to NASA's database of Earth science satellite images.

Provide teachers with training in remote sensing technology, computer usage, and problem-based learning methodology.

Significance

Engages students in problem-solving and critical thinking. Introduces an Earth systems view of the planet. Provides support tools to teachers.

COTF Classroom of the Future

Accomplishments

Designed, developed, and implemented sixteen problem-based, interdisciplinary modules dealing with such topics as land use, endangered species, habitat destruction, natural hazards, and non-renewable resources.

Conducted five teacher workshops with teachers from forty schools across the country.

Designed and delivered online teacher support materials dealing with teaching and learning.

Provided tools for student-directed inquiry to hundreds of middle schools and high schools across the country and world (over 1.7 million hits; over 101 countries expressing interest).

Conducted beta tests in thirty schools (grades 4-12) in twenty-one states during the 1996-97 school year.

Mirrored the entire site to Online Schools Singapore.

Plans

Deliver new modules and refine existing ones based on formative evaluation. This agreement ends in Fiscal Year 1998.

Point of Contact

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Fax: (304) 243-2497

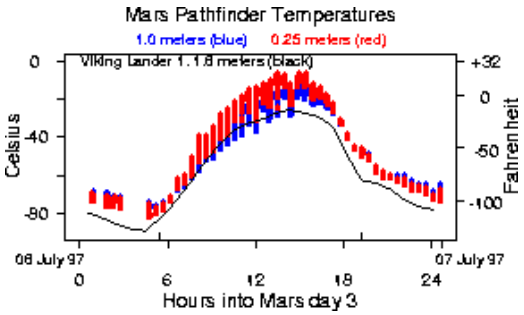
http://www-k12.atmos.washington.edu/k12

Objective

Bring real-time and retrospective atmospheric and space sciences data to K-12 students, educators, and homeschoolers, museums, and the public through the power and immediacy of the World Wide Web.

Approach

- Develop engaging educational modules that explore atmospheric and space sciences.
- Train teachers on the use of scientific data and resources available on the Web.
- Emphasize national and state science education standards.
- Evaluate the impact of Web-based modules on student learning.
- Provide "live" Mars Pathfinder and Earth meteorology data, historical Mars and Earth data, and background information to allow interpretation of the data.



Significance

This project benefits the public by making atmospheric and space data and curricula available via its Web site.

Accomplishments

Trained 180 teachers in the use of Web-based curricula through workshops, an academic year course, regional professional meetings, and site visits.

Field-tested eight Web-based curriculum modules in twenty pilot classrooms. Investigated related student learning and teacher implementation through anecdotal and formal assessments in classrooms and a summer science academy.

Presented project Web site and research results at three national professional meetings (NSTA, NCTM, and NECC).

Provided "live" Mars Pathfinder meteorology data in cooperation with the science team.

Created Pathfinder and Mars background information, including comparisons between Viking and Pathfinder data.

Received over 750 guestbook entries this year; 2.2 million Web requests (10 million hits) in July.

Plans

Conduct three teacher workshops and two national meeting presentations, continue on-site support and assessment, post four new curriculum modules and revisions to current modules, and publish assessment results.

Continue to post current Mars Pathfinder and Earth meteorology data and resources, and incorporate information on future Mars missions.

Point of Contact

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Passport to Knowledge: Electronic Field Trips to Scientific Frontiers

http://passport.ivv.nasa.gov

Objective

To develop positive attitudes toward research and technology, personalize the scientific process, and encourage skills relevant to full participation as productive workers and citizens of the increasingly information-rich society.

Approach

Conduct an ongoing series of electronic field trips which connect students and teachers to "Real Science, Real Scientists, Real Locations, Real Time" via live, interactive television, videotape, online resources, and hands-on discovery activities for school or home.

Significance

This project focuses upon inspiring students to change their career choices. It reaches an unusual number of people through its integrated dual presentation of material via both television and computer networks.

Point of Contact

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Accomplishments

Five mini-series have connected students to researchers at Earth's South Pole, high up in a NASA airborne observatory, and have provided the first-ever chance for youngsters to select targets for the world's most powerful orbiting telescope:

- Live From Antarctica
- Live From the Stratosphere
- Live From the Hubble Space Telescope
- Live From Antarctica 2
- Live From Mars

Online Web sites, hosted by project partner NASA's K-12 Internet Initiative, have received multiple awards for educational excellence and innovation, and keep resources accessible to support continuing use of the videotapes and hands-on activities.

Passport to Knowledge (PTK) has been featured by ABC, CBS, CNN, and in *USA Today, The Washington Post, New York Daily News, Chicago Tribune, Business Week*, and many other national newscasts and publications -- including a front-page article in *NSTA Reports*, the leading journal.

Featured on-camera and online scientists and students who "look like America" -- a diverse group of men and women, boys and girls, of many academic specialties.

Related Information

Browse through the following four pages for additional information on the Live From... projects.

PASSPORT TO KNOWLEDGE (PTK) is an ongoing series of "electronic field trips to scientific frontiers." Supported by the National Science Foundation, NASA, public television, and other collaborators, it encourages and permits students to interact with...

Real Science, Real Scientists, Real Locations, Real Time

PASSPORT TO KNOWLEDGE uses broadcast TV, videotape, e-mail, the World Wide Web, and hands-on discovery activities so students can actively simulate the science seen on-camera and online in their own classrooms. It's flexible so that even teachers with limited time and technology can participate. Targeted at middle school students, activities can be adapted up or down in grade, and also provide connections to math, social studies, language arts, technology education, and other disciplines, while meeting the National Science Education standards. Online discussion groups provide teacher-to-teacher support, as well as interactive projects for student-with-student collaboration.

PTK's complementary video, print, and online materials allow students to relive these unique learning experiences at any time. Students experience the process of doing science -- teamwork, problem solving, initiative, and persistence -- along with learning about the latest breakthroughs. Online resources provide extensive background, first-person field journals, an archive of student questions and expert responses, and links to other sites.

PASSPORT TO KNOWLEDGE projects include the following LIVE FROM specials:

Live From Antarctica & Live From Antarctica 2
Live From the Stratosphere & Live From the Hubble Space Telescope
Live From Mars

System Requirements

VIDEO: TV or VCR
ONLINE: Internet access (slow or high speed), e-mail, or WWW
PRINT: Teacher's Guide, student worksheets, posters

Access

http://passport.ivv.nasa.gov (gateway to all PTK projects)

Additional Information

1-800-626-LIVE (PTK HelpLine: 1-800-626-5483)
PASSPORT TO KNOWLEDGE, PO Box 1502, Summit, NJ 07902-1502
Voice: 908-598-0949 / Fax: 908-277-9590
E-mail: ghaines@quest.arc.nasa.gov or ptkghs@aol.com

LIVE FROM ANTARCTICA and **LIVE FROM ANTARCTICA 2** integrate video, print, and online materials to provide the most comprehensive and exciting interactive multimedia learning experience connecting students to Earth's most remote and mysterious continent.

Through **LIVE FROM ANTARCTICA**, students visit McMurdo Station, home of the US Antarctic program, the Dry Valleys, and America's Amundsen-Scott South Pole Station. They get a student's-eye view of astronomy at the very end of the world, see fish who live in sub-freezing waters, and spend time with the men and women who live and work in the most extreme conditions on Earth. **LFA 2** travels across the Drake Passage, the roughest seas on the planet, to NSF's Palmer Station to study giant elephant seals, week-old Adelie penguins, and to track global climate change.

System Requirements

VIDEO: TV or VCR (LFA: four sixty-minute programs; LFA2: three sixty-minute programs)

ONLINE: Internet access, viable via slow- or high-speed connections, e-mail, or WWW

PRINT: Teacher's Guide, student worksheets, poster (LFA 2 ONLY!) and NSF background: $20.00

KIT: (LFA 2 ONLY!) Includes guide, worksheets, poster, oversize USGS map, a ninety-minute teacher orientation video, NSF pamphlets, UV filters, and more: $99.00

Access

http://quest.arc.nasa.gov/antarctica
http://quest.arc.nasa.gov/antarctica2

Additional Information

E-mail: ghaines@quest.arc.nasa.gov or ptkghs@aol.com

LIVE FROM ANTARCTICA is supported in part by NSF, NASA, public television, and other public and private collaborators.

A unique opportunity for students to explore space and cyberspace

LIVE FROM THE STRATOSPHERE gives students their first chance ever to ride -- virtually -- on-board NASA's Kuiper Airborne Observatory and observe planets, stars, and galaxies with an infrared telescope. An advanced NASA satellite provides a real-time video link from takeoff through landing. The adventure climaxes with a five-hour "Night Flight to the Stars," during which students "camp in" at schools and science museums across the country, interacting with the airborne astronomers via live TV and the Internet.

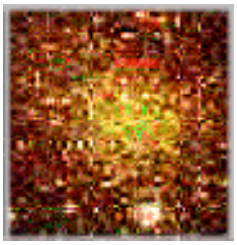
LIVE FROM THE HUBBLE SPACE TELESCOPE features another educational first: students help select targets for the Hubble Space Telescope, humanity's most powerful eye on the heavens. Actively mentored by professional astronomers, students debate online and choose to assign one orbit to Pluto and two to Neptune. The observations and results are presented during live broadcasts from NASA's Goddard Space Flight Center and the Space Telescope Science Institute.

System Requirements

VIDEO: TV or VCR (LFS is comprised of five programs of various lengths: 30 minutes, 1 hour, 2.5 hours, 5 hours, and a compilation/wrap-up of 1 hour. LHST has two one-hour segments and one half-hour segment.)

ONLINE: Internet access, viable via slow- or high-speed connections, e-mail, or WWW.

PRINT: Teacher's Guide packs for LFS and LHST include Hubble color lithographs and sample experimental materials (such as spectroscopic glasses, UV-sensitive beads, heat-sensitive paper, etc.), and may be ordered from PTK at $20.00 each.



Access

http://quest.arc.nasa.gov/lfs
http://quest.arc.nasa.gov/hst

Additional Information

E-mail: ghaines@quest.arc.nasa.gov or ptkghs@aol.com

LIVE FROM THE STRATOSPHERE and LIVE FROM THE HUBBLE SPACE TELESCOPE are supported in part by NSF, NASA, public television, and other public and private collaborators.

LIVE FROM MARS tracks NASA's two current missions to the red planet using video, the Internet, and hands-on activities to allow students to simulate the work of the mission team and bring Mars down to Earth!

"Countdown" takes students to Cape Canaveral, into a high-security clean room for the final pre-launch preparations for Mars Pathfinder, and onto the pad to witness the launch of Mars Global Surveyor.

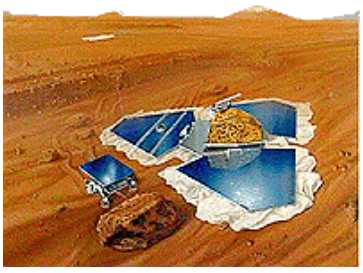
"Cruising Between the Planets" updates the missions and visits NASA's Jet Propulsion Laboratory, home to America's robotic solar system exploration. Students go behind the scenes during rehearsals for Pathfinder's July 4, 1997, landing, and explore the geology of Mars.

Special programs during **"Mars Week"** (July 4-12) and fall 1997 continue the project through the landing and into the new school year. An online collaborative project, the **"Planet Explorer Toolkit,"** provides "Mystery Site" challenges inviting students to analyze climate and other data from around the world and to solve science puzzles.

System Requirements

VIDEO: TV or VCR (PBS and NASA-TV)
ONLINE: Internet access, viable via slow- or high-speed connections, e-mail, or WWW
PRINT: Teacher's Guide, student worksheets, poster, and NASA background: $20.00
KIT: Includes Guide, a sixty-minute teacher orientation video (including "Mars the Movie," a Martian meteorite news release, computer graphics of both missions, and more), an original twenty-slide set, a CD-ROM ("Mars Navigator"), the "Mars Explorer" map/ poster, and more -$99.00

Access
http://quest.arc.nasa.gov/mars



Additional Information
E-mail: ghaines@quest.arc.nasa.gov or ptkghs@aol.com

LIVE FROM MARS is supported in part by NASA, NSF, public television and other public and private collaborators.

Science Information Infrastructure

http://www.cea.berkeley.edu/Education/SII

Objective

Bring Earth and space science remote sensing information to the public through the nation's science museums.

Approach

SII enables access to Earth and space science through the nation's science museums through a network created by teams of teachers, science museum personnel, researchers, and technical staff, and hosted by the science museums.

Accomplishments

Science Education Gateway * (SEGway)

A new resource site for teachers, students, and public education, SEGway offers three tiers of resources: complete lesson modules; grab bags of stand-alone tools and activities; and resource links and lesson templates for creating new modules. Resources are also organized thematically. SEGway has been listed in a number of education resource sites on the Web, and several modules have won awards.

Lesson modules now online:

- Auroras!
- Best of the Solar System
- Big Trouble in Earthquake Country
- Classifying Galaxies
- The Comet's Tale
- Find That Comet!
- Graphing Stratospheric Ozone
- The Great Satellite Search
- Ice on Venus?
- The Light Tour
- The Martian Sun-Times
- Measuring Stellar Temperatures
- Ski Earth
- Spectra from Space
- Take a Spin through the Solar System
- Third from the Sun-Geographical Features from Space

Accomplishments (cont.)

Sample Grab Bag Resources:

- Exploring the Planets Online Gallery
- What's in a Comet Anyway? (game)
- NASA Scientist Answers Aurora Questions on RealAudio
- Build Your Own Spectroscope
- Image Animation of Solar Rotation

Testing and Evaluation:

- Several lesson modules successfully pilot-tested in Oakland, CA, classrooms in the 1996-97 school year.
- Extensive classroom testing with teachers and students in several states starts in the fall of 1997.
- Lesson modules tied to National Science Education Content Standards.

Significance

The SII demonstrates successful partnerships between research institutions, museums, and educators to create educational resources. Each participant brings particular expertise, experience, and perspective to craft resources tuned to teachers' needs.

Plans

Continue development and dissemination of Web-based resources for education. Disseminate the project's model of institutional collaboration. Seek funding to complete evaluation of resources. Establish a long-term self-sustaining structure. Current agreement ends in Fiscal Year 1997.

Point of Contact

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*http://www.cea.berkeley.edu/Education/SII/SEGway

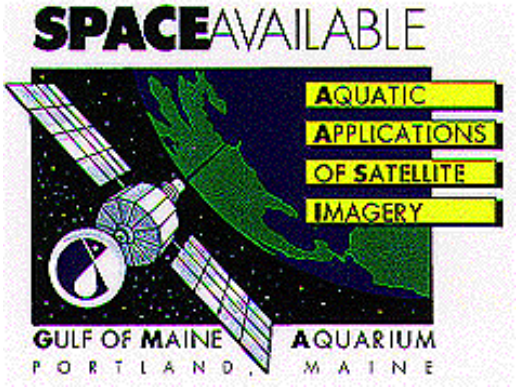
http://octopus.gma.org

Objective

To teach K-12 students about aquatic environments using satellite imagery distributed via the Internet.

Approach

Remote sensing is used to teach about aquatic environments. Students are provided a hands-on experience with the information-linking benefits of the Internet.



Significance

Students across the state of Maine, a largely rural area, are being exposed to the Internet and NASA's remote sensing technology.

With NASA support, the Gulf of Maine Aquarium has developed the capacity to deliver innovative marine education programming to any K-12 and public audience with WWW access.

Accomplishments

Authored, tested, and published sixty-seven classroom activities, both in print and electronically on the World Wide Web, that use satellite data to teach about aquatic environments.

Delivered six statewide teacher workshops to instruct K-12 educators in the classroom use of these materials and the World Wide Web.

Completed twenty in-school days across the state, working with teachers who had participated in workshops to help them implement classroom activities.

Produced and distributed a classroom poster identifying World Wide Web sites with aquatic images to 2,800 K-12 classrooms in Maine.

Attended and/or presented at sixteen state, regional, and national conferences having to do with remote sensing of the marine environment.

Plans

Having fulfilled our NASA program objectives, we have launched three new WWW-based initiatives that will make our server and outreach capacities self-supporting.

Point of Contact

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Virtually Hawaii

http://satftp.soest.hawaii.edu/space/hawaii/
http://hawaii.ivv.nasa.gov/

Objective

To promote tourism and space education in Hawaii.

Approach

Deliver remote sensing images of Hawaii to the public via an Internet Web site.

- Live video from three sites on Oahu and Maui plus live GMS and AVHRR satellite images.
- QuickTimeVR panoramas of four islands.
- "What's New on the Volcano"
- Electronic "Virtual Field Trips" of Kauai, Oahu, Molokai, Maui, and the Big Island.
- Clickable "Image Navigator" maps of every island showing Landsat, SIR-C, SPOT, aircraft, and space shuttle images.

Accomplishments

- Featured on national TV and in *Time* magazine ads for Intel Corporation's Pentium chip.
- Included on Netscape's "What's Cool" for twenty months.
- Featured in April 1996 issue of *Earth* magazine.
- 1.5 - 2.2 million hits/month for over two years.

Significance

This is one of IITA's most accessed servers and is on track to become a successfully commercialized application of remote sensing technology.

Plans

The effort is currently exploring options for becoming self-supporting upon expiration of its cooperative agreement. Hard copy media (books and CDs), as well as sponsors of electronic pages, are being developed.

This agreement has been extended until August 1998.

Point of Contact

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Honolulu, HI 96822
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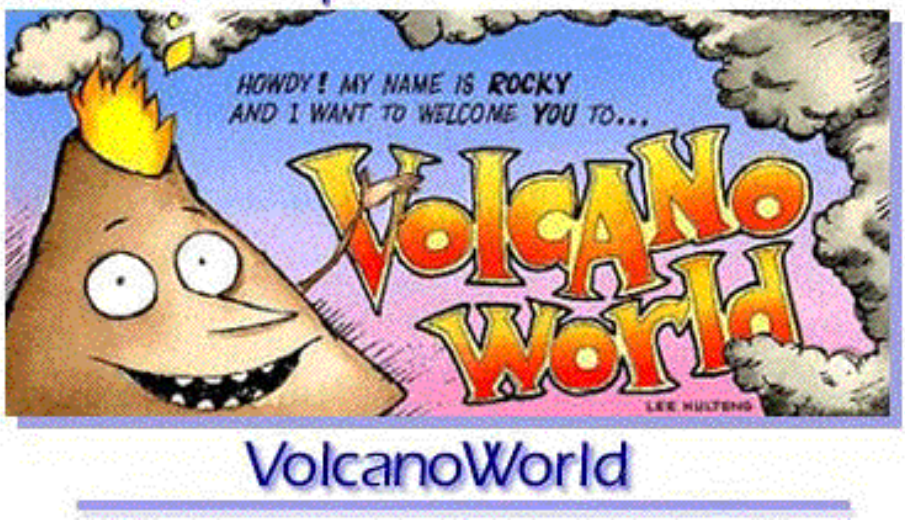
Phone: (808) 956-3147
Fax: (808) 956-6322



http://volcano.und.nodak.edu

Objective

To enrich learning by delivering high-quality remote sensing images, information, and interactive experiments which add depth, variety, and currency to existing volcano resources.

Approach

Bring near real-time volcano information to school kids and other users of the Internet and the World Wide Web. VolcanoWorld draws extensively on remote sensing images and other data collections. Each image is related to geologic processes, and users are encouraged to ask professional volcanologists questions.

Point of Contact

Dr. Charles A. Wood, Principal Investigator
Space Studies Dept.
Univ. of North Dakota
E-mail: cwood@badlands.nodak.edu

Accomplishments

- 7,000+ pages of information
- 1,000,000+ visitors and still counting
- Rated in top 5% of Web sites

Significance

- This project maintains one of IITA's most-used Web sites and teaches a large number of people about NASA's remotely sensed images.

Plans

- Live VolcanoCam
- Kiosks at Volcano Parks
- Live Ask a Volcanologist

NBC4 WeatherNet4

http://wxnet4.nbc4.com

Objective

To deliver compelling Earth & space science data and images into the homes of millions of Americans through broadcast television and the Internet.

Approach

Develop an Internet Web site which is used to disseminate updated weather information and forecasts. This site provides more detailed information about images seen on NBC4 in Washington, DC.

Significance

Through the Internet, WeatherNet4 is reaching millions of people worldwide, providing visualizations of Earth and space that will lead to protection of life and property.

Point of Contact

NBC4 WRC-TV
4001 Nebraska Ave., NW
Washington, DC 20016
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Fax: (202) 885-4512

Accomplishments

We set a record number of hits in July with 3,704,226. This brings the yearly total (as of September 1997) to over 17 million hits. That represents a 59% increase over 1996.

We continued to incorporate our 4-Winds project into WeatherNet4 by creating prototype Java versions of real-time weather sensors. These images will be used on the air, as well as in schools, to give students a real-time view of changing weather conditions. These Java versions will be available in early 1998.

We added satellite sectors to our Interactive Satellite Image page (http://wxnet4.nbc4.com/satelliteimages.html). The Pacific Northwest and California visible images have been a welcome addition for the public and schools nationwide.

We are testing a mesoscale weather forecast model in conjunction with NOAA's Air Resource Lab. This model will be used to visualize future weather events on television and on the Web.

We conducted three National Weather Service "Skywarn Training Classes" for our Web-Weatherwatchers (observers of daily weather conditions who report through WeatherNet4). This effort will allow the NWS to utilize WeatherNet4's Web-Weatherwatcher program as a resource for issuing severe weather reports and collecting verification information.

Presentations were made at the AMS Broadcaster's Conference, AMS Annual Meeting, NASA Goddard, and other locations on the resources available through WeatherNet4 and how the community can participate.

WeatherNet4 continues to be a feature item within our daily weathercasts, and this exposure continues to enhance the public's exposure to Earth and space science data.

Extensive exposure was given to the Mars Pathfinder mission, with images posted on WeatherNet4 for access.

Related Information

See the WeatherNet4 product profile on the following page.

NBC4 & NASA Team up to Produce a Whole New World of Weather...

Welcome to WEATHERNET4

WeatherNet4 is a first-of-its-kind project involving NASA and a broadcast television station. The intent is to increase the American people's exposure to Earth and space science data via the Internet and broadcast TV. It has proven that the television meteorologist/weathercaster is indeed a "**Science Ambassador,**" ready to deliver Earth and space science information daily to those watching television. By using state-of-the-art technology and communications, NBC4 WRC-TV in Washington, DC, has established the most comprehensive local Web site dedicated to weather and Earth and space science.

Innovative visualizations of weather have motivated many Americans to get connected to the Internet in the Washington, DC, area and across the nation. This increases the use and public awareness of NASA and NOAA data and information tremendously.

WeatherNet4 Provides:
Educational Resources / Real-Time Weather Database / Interactive Satellite Images / Weather Data Archives / Community Interaction / Online Bulletin Board / Weather Games / Recreational Weather Resources / Web Weather Watchers / Special Skywarn Training Classes / StormTrack4/ Severe Weather Updates / What's New in Space & Science / Space Weather Page / Ski Net / Mountain Net / Homework Helper / Document Distribution via Adobe Acrobat / On-Air Weather Quiz/ RealAudio Weather Forecasts / Observation of the Week

System Requirements

WeatherNet4 can be accessed via the Internet.
Computers should be equipped with the proper Internet browsing software.

Access

http://wxnet4.nbc4.com

Additional Information

WeatherNet4 & Dave Jones have been featured in *The Washington Post, TV Week, Communications Week* magazine, *INSIGHTS* (NASA publication), *USA Today, WeatherWise* magazine, and Netscape's What's Cool. We have received numerous Web awards and been named an NBC Site of the Week. Additional collaboration is very likely with NASA, universities, and corporations throughout the country. Commercial applications of remote sensing data are currently being investigated.

To find out more about WeatherNet4 and its many applications, contact:
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4001 Nebraska Ave., NW, Washington, DC 20016
Phone: 202-885-5069
E-mail: dave.jones@nbc.com

Windows to the Universe

http://www.windows.umich.edu

Objective

To develop a fun, innovative, and engaging Web site about the Earth and space sciences.

Approach

Make connections between the Earth and space sciences and the human experience by providing information on history, art, and mythology.

Significance

Windows is unique in linking to examples from mythology and art to increase people's interest in science. The system is also unique in its ability to tailor the presentation of material to either beginner, intermediate, or advanced levels of description.

Accomplishments

Released version 2 of Windows to the Universe on October 1, 1996, and version 3 on April 1, 1997.

The site has experienced explosive growth over the past year, receiving an average of 3,000 sessions per day.

Received over 20 major Web awards.

Site content development activities for the year included: major expansion in the areas of astrophysics, constellations, Earth science, mythology, philosophers, and scientists; the addition of an "Ask a Scientist" section; maintenance of a rapidly updated News portion of the site.

Opened the "Space Weather" section of the site in collaboration with the Public Connection and WeatherNet4 projects.

Plans

Version 4 of Windows to the Universe will open on December 1, 1997, with major expansions in atmospheric science, constellations, teacher resources, K-12 curriculum activities, origins of life, and the Sun.

A new CD-ROM will be prepared for distribution upon the release of version 4.

Point of Contact

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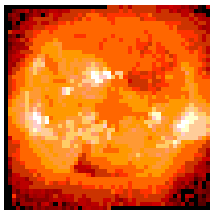
Yohkoh Public Outreach Project



http://www.space.lockheed.com/YPOP/

Objectives

- Make science appealing to the general public, particularly the younger generation.
- Promote NASA programs.
- Increase public awareness of NASA's international scientific programs.

Approach

Make movies of solar observations and results of solar research available for public access via the Internet.

Work with educators to make educational information about the Sun available to K-12 students in an interactive format.

Accomplishments

Web site put online using a movie theater motif featuring solar movies recorded by the Yohkoh satellite.

A one-a-day movie for the Yohkoh mission is accessible via the Internet.

Interactive *Solar Tour* online.

Solar Classroom online.

Teachers' Writing Workshop held July 1997.

Significance

This project uses spectacular animations to interest students and the public in space.

Plans

A tutorial on the magnetic nature of the Sun is being drafted. Lesson plans involving Yohkoh data are being finalized for inclusion in the Web site. A Latest Solar Images page is being generated and should be online by October 1997. A streamlined site designed for feedback purposes is planned for fall 1997. The reprocessing of the data for the final version of the movie is under way. Agreement expires in Fiscal Year 1998.

Point of Contact

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The Earth System Science Community

http://www.circles.org
http://www.ecologic.net/ESV

Objective

To enable students, educators, and the general public to research the Earth system using Earth observation data and information over the Internet.

Approach

Provide syllabus, project descriptions for student investigation (which are supported by teaching resources), test questions, activities, tutorials, and online access to data.

Accomplishments

Developed a production version of the Earth System Visualizer (ESV). The purpose of the ESV is to enable analysis and intercomparison of seventeen Earth system parameters using a variety of plot types and projections. The site includes a tutorial and example cases.

Developed an Earth system science curriculum based on the strategy of the Earth Observing System and numerous NASA online educational resources.

Attendance at five conferences to demonstrate our work and disseminate information about the ESSC and our data.

Significance

Students learn how to evaluate and publish the results of their team research on the Internet. The materials, tools, teaching resources, and examples of student research published on the ESSC Web sites may be used to supplement existing curricula in Earth and environmental science, physics, chemistry, and beyond.

Plans

We will continue to provide the ESSC Web services to our community over the Internet. Our cooperative agreement ends in Fiscal Year 1997.

Point of Contact

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Washington, DC 20016
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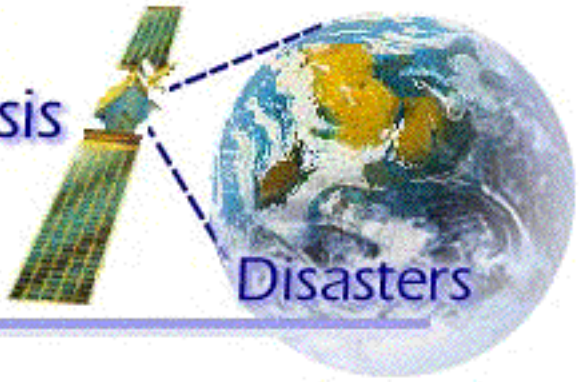
Emergency and Crisis Management



http://pearl.ias.unt.edu:9876/

Objective

Increase awareness of NASA technologies for disaster reduction.

Approach

An Internet WWW site has been established that allows people to find out more about natural and technological hazards, and learn how to use satellite remote sensing for disaster planning, response, and mitigation.

Significance

Improved community disaster response capabilities, with an emphasis on helping disadvantaged and minority groups.

Point of Contact

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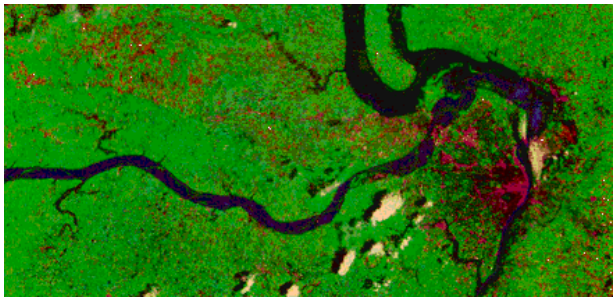
Fax: (817) 369-8771

Accomplishments

- Held workshop with Native Americans, co-sponsored with FEMA Region VI. The workshop had local, national, and international participation and received regional TV and newspaper coverage.
- Established new collaboration with the Red Cross and the State of Tennessee.
- Web site is 60% complete. Most of the pages were redesigned with better graphics and new Web capabilities.

Plans

- Complete remainder of WWW site.
- Test the effectiveness of the site with new users.
- This project expires in Fiscal Year 1997.



This satellite image shows the Mississippi River flood in St. Louis during 1993.

Land Management Applications of Remote Sensing Data

Bay Area Digital GeoResource (BADGER) - Lockheed Martin

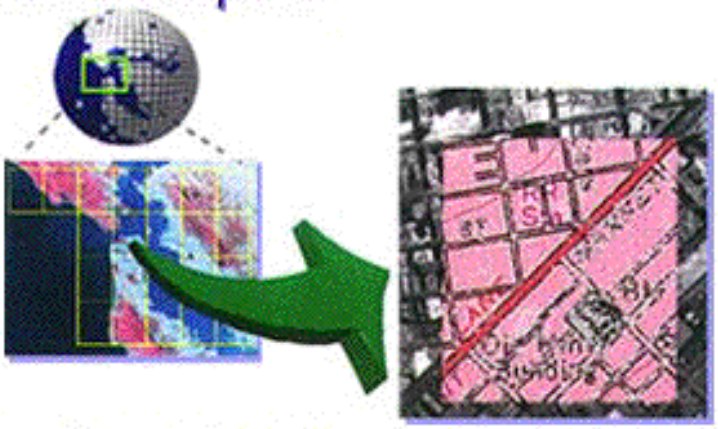
Flood Management Enhancement Using Remotely Sensed Data - Sentar, Inc.

ForNet Forest Management - University of Minnesota

Timely Satellite Data for Agricultural Management (TiSDat) - University of Wisconsin

Urban Environment Initiative (UEI) - Prime Technologies

See also the following Educational Application of Remote Sensing Data project:
Emergency and Crisis Management - University of North Texas 24



Bay Area Digital Geo Resource

http://badger.parl.com/

Objective

To create a marketplace for Bay Area geographic data users, vendors, and service providers.

Approach

Provide San Francisco area local governments, utilities, businesses, and public organizations with access to geographic data via an Internet WWW server.

- Environmental features, property lines, and demographic information are viewed in context with one another.
- High-quality digital base map of the San Francisco Bay Area serves as a common reference.

Point of Contact

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Significance

BADGER will provide low-cost public access to non-traditional users, increasing data sharing and providing environmental insights.

Accomplishments

Over 16 gigabytes of geo-referenced imagery and data available over the WWW.

Developed advanced access methods for locating and viewing data sets, including the Java Magic Lens.

Developed customized applications for electronic permitting (non-point source) and natural hazard prediction.

Co-founded the Bay Area Shared Information Consortium (BASIC), a State of California 501(c)(3) nonprofit company operating the BADGER Online Service for users and data vendors.

Plans

This agreement expired in Fiscal Year 1997.

Sentar
Today's Solutions, Tomorrow's Innovations

Flood Management Enhancement Using Remotely Sensed Data

http://www.sentar.com/NASA/Flood_Management.html

Objective

To integrate remote sensing data products with a Geographical Information System (GIS) to provide emergency managers with enhanced support during and after floods.

Approach

- To use NASA DAAC data and aerial data in disaster management.
- To develop concepts for communicating flood management data using the Internet.
- To demonstrate a concept for enhancing flood disaster management.

Significance

The immediate beneficiaries are the emergency response managers who can better perform their missions through accessing and analyzing maps and remote sensing images of disaster areas. The ultimate beneficiary, however, is the public, who will be better able to prepare for, react to, and recover from disasters.

Accomplishments

- Developed a design concept for a prototype system for emergency managers.
- Developed an initial build of a graphical user interface for the prototype system.
- Developed a tool to reformat processed remote sensing data to import to the ARC/INFO GIS.
- Acquired and processed satellite, ortho, and oblique aerial imagery for the GIS.
- Completed and delivered an integrated tool/environment to the Alabama Emergency Management Agency.

Plans

To expand the capability, with additional remote sensing data products, to support emergency workers in all types of manmade and natural disasters, and to use the Internet for all data communications between data providers, processors, and users. This project expired in the second quarter of Fiscal Year 1997.

Point of Contact

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ForNet Enhanced Access for Forest Management

http://www.gis.umn.edu/fornet

Objectives

Develop tools and techniques for effective Internet delivery of spatial and related natural resources data to management professionals and the public.

Approach

- Outreach to determine needs.
- Plan solutions for meeting needs.
- Develop WWW/spatial data tools for delivery of solutions via the Internet.
- Establish a testbed of products implementing the solutions.
- Provide workshops and training for Department of Natural Resources personnel and related users.

Accomplishments

- Implemented WWW server providing access to more than 7.5 gigabytes of natural resources-related data.

- ForNet ImageView: software for working with large image data sets via the WWW. ImageView uses ERDAS Imagine files as input and allows users to query, display, manipulate, and download targeted views of remotely sensed imagery.

- ForNet MapServer: software for bringing interactive maps to the WWW. MapServer works with ESRI shapefiles and allows users to create custom maps on the fly by viewing only what they want, where they want it. The software uses templates to simplify application development and maintenance. MapServer has been implemented by a significant number of WWW spatial data providers around the world.

- Java and JavaScript versions allow ImageView and MapServer graphics to be used within a single application. Users can overlay vector GIS data on raster (e.g., Landsat TM) data, providing a more comprehensive view of the resource.

Accomplishments (cont.)

- A wide variety of applications have been built using ForNet ImageView and MapServer, including:

    - forest fire information
    - aerial photography index
    - forest stand inventory access
    - Landsat TM visualization and download
    - AVHRR vegetation change visualization
    - ecosystem classification support

- Held two major workshops and twenty training and demonstration sessions.

- ForNet was publicized in over twenty magazine and newspaper articles, had displays at fifteen conferences and events, and was featured on Minnesota public television. ForNet has also produced an educational video for distribution to the professional community, schools, and other potential users.

Significance

- Improved the quality and integrability of remote sensing and related spatial data for land management decision making.

Plans

- Complete documentation of software tools, assist cooperator in implementing fully populated applications, and formally evaluate project result adoption process. Agreement expires in Fiscal Year 1997.

Point of Contact

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TiSDat

Timely Satellite Data for Agricultural Management

http://bob.soils.wisc.edu/nasacan.html

Objective

To apply remote sensing technology to agriculture through the creation of innovative Decision Support Systems (DSS) which rely on satellite observations.

Approach

Develop the following three tools:

- an irrigation scheduling product and associated electrical power demand product
- a frost forecasting system
- a plant disease prediction system

Accomplishments

The irrigation scheduling and frost protection Decision Support Systems (DSS) are now online.

These, as well as a solar insolation product (associated with the irrigation DSS), are viewable at http://bob.soils.wisc.edu/wimnext/.

The plant disease product is available to growers as a software patch to the Integrated Pest Management tool WISDOM, an established DSS used by growers in Wisconsin and other Midwestern states. The electrical demand product is in the final development stage.

Significance

Agricultural managers will benefit from timely information needed to decide when irrigation and fungicides are necessary and what steps must be taken to protect crops from frost damage, potentially resulting in large monetary savings.

There is a large potential for expansion of these products to other crops and regions.

Plans

The agreement will be extended through Fiscal Year 1998 to provide a supplementary year of service to growers and to explore additional avenues of commercialization.

Point of Contact

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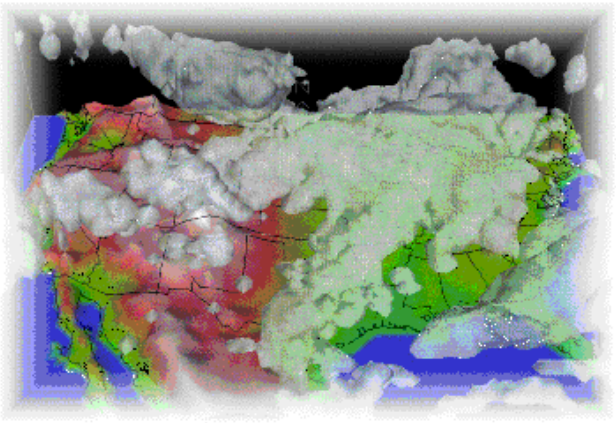

The 3-D mesoscale model used in this research, the Subsynoptic Scale Model (SSM), is a hydrostatic, semi-implicit, primitive equations model which is an adaptation of the Australian Region Primitive Equations Model to the Northern Hemisphere.

The Urban Environment Initiative

http://muspin.gsfc.nasa.gov/Prime/

Objective

To provide public access to non-traditional users of Earth science information and promote its use, with a focus on the environment of urban areas.

Approach

The UEI team will provide non-traditional users of Earth science information with technologies that will allow them to collect, visualize, and analyze information about our urban environment.

Thematic Guides will provide a tool that will allow researchers, policy makers, educators, and the public to quickly access selected background materials on key urban, environmental, and global change issues.

Significance

This project has a strong focus on bringing remote sensing to non-traditional and disadvantaged users.

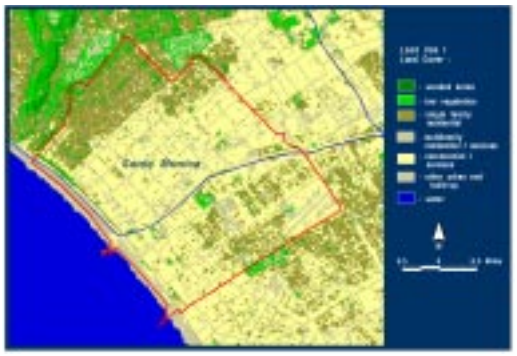

Image from Urban Environment Initiative Sampler CD: Santa Monica, California, image showing integration of remote sensing image with other geographic information.

Related Information

See Prime Technologies' tour of Washington, DC, at http://muspin.gsfc.nasa.gov/Prime/dctour/primetour.html.

Accomplishments

Established a primary Web site for general public access to selected UEI information "products," including GIS and remote sensing information.

Developed a CD Sampler software product which contains remote sensing images and maps for both Los Angeles County and the Dayton, Ohio, area.

Began establishing a beta testbed environment to support specific information needs and end-user requests from specific organizations with whom the UEI team has established ongoing relationships.

Plans

Conduct workshops and training sessions related to GIS and remote sensing information and technologies.

The UEI team is working with the Washington, DC, -based, Center for Environment, Commerce, and Energy, which has an extensive database on Brownfield sites and CERCLIS (i.e., EPA-defined hazardous waste) sites in the Washington, DC, metropolitan area. The UEI team is integrating this information as part of a new UEI Urban CD-ROM now in preparation. This CD-ROM will also include Landsat TM images of the Washington, DC, area for the '70s, '80s, and '90s.

The UEI team is also collaborating with the American Visions Society (AVS), a major magazine publisher with over 60,000 subscribers to its *American Visions* magazine. AVS has established a community-oriented Web site (www.americanvisions.com) and has agreed to work with the UEI team to implement a nationwide, online, interactive discussion forum centered on the UEI team's environmental content. This online forum will be available to both AVS subscribers and other interested community organizations.

Point of Contact

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Public Outreach Applications of Remote Sensing Data

Remote Sensing Public Access Center - BDM International

See also the following Educational Applications of Remote Sensing Data and Digital Library Technology projects.

Educational Applications of Remote Sensing Data:

Digital Library Technology:

Objective

- **IITA Support** -- Provide support for NASA's Information Infrastructure Technology and Applications (IITA) project teams and their activities.
- **Public Outreach** -- Increase the public's access, via the Internet, to space observations of the Earth, our solar system, and the universe beyond.

Approach

- Develop tools, services, and mechanisms for collaboration that benefit IITA projects (developers.ivv.nasa.gov).
- Increase IITA visibility and showcase NASA activities via NASA's Observatorium Web site (observe.ivv.nasa.gov).

Point of Contact

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Phone: (304) 367-8345
Fax: (304) 367-8211

Related Information

- RSPAC Programmatic:
  http://rspac.ivv.nasa.gov/
- NASA's Observatorium:
  http://observe.ivv.nasa.gov/
- Developers' Workshop:
  http://developers.ivv.nasa.gov/
- "Exploring the Internet with NASA" CD-ROM:
  http://cdrom.ivv.nasa.gov/
- NASA Learning Center, Fairmont, WV:
  http://nasalc.ivv.nasa.gov/

Accomplishments

- Developed the "Exploring the Internet with NASA" CD-ROM, an entertaining multimedia experience which introduces young students and first-time adult users to the Internet.
- Developed seven multimedia kiosks to showcase Internet technologies and NASA educational products. The kiosks are the focal point of the NASA Learning Center, located in Fairmont, WV.
- Posted over 30 major and 150 minor articles on Earth and space science topics to NASA's Observatorium Web site. The site was favorably recognized by the national media (*New York Times*, *USA Today*, *The Washington Post*, *Astronomy* magazine, Yahoo!, and many others) and received over 18 million hits.
- Produced and distributed the IITA Bulletin, a monthly newsletter, to NASA and IITA project recipients.
- Tested and evaluated the structure and integrity of seventeen IITA project Web sites.
- Exhibited at ten national and eleven regional conferences to promote the activities of the IITA.
- RSPAC Web servers, which host fourteen IITA projects, were responsible for 45 million hits.

Plans

- Maintain legacy data sets online for continued public access as individual IITA projects expire. This agreement expires in Fiscal Year 1999.

The Movie Gallery

This is a listing of movies that are a part of the online version of the IITA 1997 Annual Report.

Hurricane movies from the Public Use of Remote Sensing Data project at Goddard Space Flight Center: (http://rsd.gsfe.nasa.gov/rsd/movies/movies.html)

- Hurricane Fran Flyby -- September 4, 1996 (316K MPEG movie)
- Hurricane Luis -- September 6, 1995 (3,800K QuickTime movie)
- Hurricane Marilyn -- September 15, 1995 (8,400K QuickTime movie)

Yohkoh Public Outreach Project (YPOP) Film Festival -- The Sun in X-ray: (http://www.space.lockheed.com/ypop/filmfestival/index.html)

- Wavelength Fade -- White light to soft X-rays (130K MPEG movie)
- Sun Diver -- Solar Flyby (670K MPEG movie)
- Solar Eclipse -- October 24, 1995 (177K MPEG movie)
- SXT White Light Data -- Comparison of X-ray to White Light / X-ray vs. Sunspot / Differential Rotation 10-JAN-92 18:38:36 - 9-MAR-92 09:24:25 (225K MPEG movie)

Movies from NASA's Observatorium Movie Gallery: (http://observe.ivv.nasa.gov/nasa/gallery/movie)

- Space shuttle launch of the shuttle orbiter (1,100K QuickTime movie)
- The Landing Systems Research Aircraft (LSRA) (1,749K QuickTime movie)
- The Ames-Dryden-1 (AD-1) research aircraft (1,272K QuickTime movie)
- Voyager 2 flyby of Saturn (802K QuickTime movie)

Movie clips from the "**Exploring the Internet with NASA**" CD-ROM produced by the Remote Sensing Public Access Center (RSPAC): (http://cdrom.ivv.nasa.gov)

- Space Galleon (1,457K QuickTime movie)
- Introduction (6,815K QuickTime movie)
- Time Warp (11,327K QuickTime movie)
- ICU2, The Talking Computer (5,405K QuickTime movie)
- Hawaii Flyby (1,598K QuickTime movie)
- Professor Wayfar (2,844K QuickTime movie)

These movies may be viewed online at http://iita.ivv.nasa.gov/program/iita1997/rsd/rsd_mov.html.

Digital Library Technology

Objective

NASA seeks to develop and demonstrate technologies needed to build digital libraries to electronically access NASA science data.

Approach

NASA funds seven cooperative agreements in digital library technology.

NASA also funds, along with the National Science Foundation (NSF) and the Defense Advanced Research Projects Agency (DARPA), the Digital Library Joint Research Initiative. This four-year, multiagency effort funds six cooperative agreements. The Joint Research Initiative was initiated in 1994 and continues through 1998.

Point of Contact for Digital Library Technology Projects

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NASA Digital Library Cooperative Agreements

These projects develop and demonstrate technologies needed to build digital libraries to electronically access NASA science data.

Data Communications

CableNet: Reaching NASA from Home -- Internet Access via Cable TV - Computer Sciences Corporation

Data Compression

Progressive Image Transmission - University of Wisconsin

Interoperability

Universal Spatial Data Access Consortium (USDAC): The GeoLens Project - Bellcore

Search

Retrieval of Digital Images by Means of Content - IBM
Scalable Agent-based Information Retrieval Engine (SAIRE) - Lockheed Martin

Visualization

Project Horizon - NCSA, University of Illinois
The Public Connection - Rice University

Reaching NASA From Home
Internet Access Via Cable TV

http://192.86.20.177/

Objective

To demonstrate a Cable Area Network (CableNet) linking households within the same CableTV service area. Also, those networked households will be connected to the rest of the world via the global computer network, the Internet.

Approach

Reuse existing cable TV wiring into the home to achieve higher bandwidths at lower cost than available through alternative means.

Significance

Cable systems offer the potential for much higher communication data rates into homes and schools than is possible through use of current telephone network lines into the home.

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Accomplishments

Proved transmission concept. Discovered how to use ordinary television signal for high-speed data. Our signal can be transmitted wherever and however TV signals are broadcast.

Designed protocol. Modified and simplified Ethernet protocol so that it works on a county-wide network. Provides interface between Internet and "CableNet" addressing domains.

Built cable modem. Designed circuit boards and integrated hardware and software to produce set top box incorporating cable modem and network router technology.

Operated service. Provided service to Rolling Knolls Elementary School in Annapolis, Maryland, using channels donated by Jones Intercable.

Worked with children. Introduced children of all grades and backgrounds to the Web. Held regular teaching sessions using Web content to augment class study projects.

Simplified concept. Developed a service concept - The Digital Channel - that could be used in elementary schools and in homes without personal computers and that can be used without changing CATV systems or adding telephone lines.

Found interested investors. We are actively engaged in discussions with investment groups that have the financial resources to implement The Digital Channel on a global scale.

Progressive Transmission of Digital Images

http://www.sal.wisc.edu/~jwp/can.html

Objective

To allow high-performance image browsing over low-performance networks.

Significance

This project allows students, scientists, and other Web users to browse and download large images over slow networks. Digital image librarians will benefit from reduced storage and network demands.

Point of Contact

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Accomplishments

Enhanced the Progressive Image Transmission (PIT) system to allow full-color images and "cropping on the fly," where real-time, user-defined regions of interest arrive even faster than the rest of the image.

These pictures show the dramatic improvement in network speed using our technique of Progressive Image Transmission. We chose an image typical of those found on the Web, except that this is a full-color, 640x480, 24-bit image, not a compressed GIF or JPEG. This is large (7.4 megabits) compared to images currently being sent over the Web.

We show the image as it appears after thirty seconds, two minutes, and the full fifty-minute transfer time using a 2400 baud modem. At the displayed resolution, there is no detectable difference, even at a compression of 125. For comparison, note that at this ultra-low bandwidth, the image would appear at the rate of one line (out of 480) every 6.4 seconds using the traditional line-by-line mode.



Plans

We are building a Web-ready Java version of the PIT system.

The Universal Spatial Data Access Consortium (USDAC) GeoLens Project

http://usdac2.rutgers.edu/

Objective

Invent technology that makes NASA's satellite imagery easier to use with other federally-provided geospatial data.

Approach

Develop and place in the public domain innovative digital library technology to make NASA's Earth science data accessible to a broad community of users over the Internet.

- Implement the Open Geodata Interoperability Specification (OGIS)
- Build on WWW infrastructure
- Support dynamic schema and schema translation
- Enable data catalog federation
- Provide attribute- and content-based search of metadata
- Implement standards such as FIPS, FGDC, CSDGM, and HDF-EOS
- Support ESIPs and "DAAC-in-the-Box" models

Significance

This project is laying fundamental groundwork for geographic information standards that is of broad importance to all of NASA's remote sensing activities.

Accomplishments

- Digital Line Graphs stored in Spatial Data Transfer Standard - Vector Profile formats. This service supports both point and line extraction and clip with user-provided bounding box. GeoLens Data Access Services now provide extractions of three framework geospatial data types: vector (USGS DLG), gridded (USGS DEM), and raster (Landsat MSS stored in HDF EOS containers).
- Enhanced the GeoHarness Catalog Service to (a) load and return repeated attributes (e.g., Additional Attribute in the ECS Metadata Standard), (b) combine content-based and attribute-based queries on metadata, (c) reference data access services directly in GeoHarness

Accomplishments (cont.)

catalogs, (d) support recursive queries over collection trees (or subtrees) of geospatial data repositories, (e) enable COVER, INTERSECTION, and INCLUDED_WITHIN methods on user-provided bounding boxes to query footprints of data objects referenced in GeoHarness catalogs, and (f) started work to enable federation of distributed GeoHarness catalogs.

- Advanced work on the GeoLens Client to (a) support use of plug-in services (e.g., the USGS GNIS Gazetteer service) to build bounding boxes from user-provided place names, (b) present repeated metadata attributes, (c) provide GUI for selecting use of bounding boxes in spatial queries, and (d) enhance advanced query capability needed to combine attribute-based and content-based queries on GeoHarness catalogs.
- Further developed our Schema Mapping Service to provide simple translations between the FGDC Metadata Content Standard (Version 1) and the ECS Metadata Standard (Release A) to support catalog queries and data access.
- Began work on a Metadata Access Layer to make it possible to interface the GeoHarness Catalog Service with any commercial DBMS used to store metadata.
- Work on an Open GIS-like viewer was initiated and is now near completion. This application will present to the end-user overlays of data extracted by GeoLens Data Access Services remodeled as OGIS-like Well-Known Structures (i.e., Grids and Simple Features).
- The Open GIS Consortium's Technical Committee (a) approved CORBA, OLE/COM, and SQL implementation specifications for Open GIS Simple Features, and (b) drafted and released an RFP for OGIS Pixel Manipulation Services.
- Paper on GeoLens System was accepted for presentation at the second IEEE Metadata Conference, held in Silver Spring, MD, September 16-17, 1997.

Point of Contact

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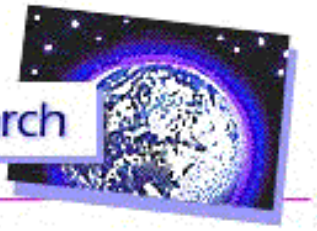
Retrieval of Digital Images by Means of Content Research



http://maya.ctr.columbia.edu:8080

Objective

To provide the capability for scalable, content-based searches of large satellite image archives over the Internet.

Approach

Develop a system with the following features:

- Satellite image server supports scalable, content-based (feature) searches of large image libraries.
- Content-based searches of images are object-oriented, where the search targets are specified in terms of simple or composite objects. Simple objects can be specified at the pixel, features (texture, spectral histogram, or shape), and semantics levels, while composite objects are constructed from multiple simple objects with fuzzy or precise spatial, temporal, or boolean relationships.
- A progressive search paradigm is adopted where the search speed is obtained through the use of highly compressed, low-resolution images for initial culling, with selective search of full-resolution data on only those images that survive the culling.
- Search targets are defined through a Java-based drag-and-drop user interface. Users may also invoke predefined queries, or define their own search targets using system-defined features.

Accomplishments

Delivered a prototype system to the U.S. Forest Service. This system includes content-based queries for locating fires/fire scars.

Developed a progressive framework to efficiently represent, index, and retrieve large amounts of satellite imagery.

Achieved a speed-up factor of more than 500 times for some content-based operations, such as classification.

Developed recipes for a set of scenarios that require content-based queries, such as solar flare detection, global change detection, and fire and fire scar locations.

Significance

This project seeks to demonstrate the feasibility of efficient image indexing and retrieval for image databases larger than one petabyte.

Plans

Develop additional scenarios for detecting hantavirus, solar flares, and Mars craters. This project expires in Fiscal Year 1998.

Point of Contact

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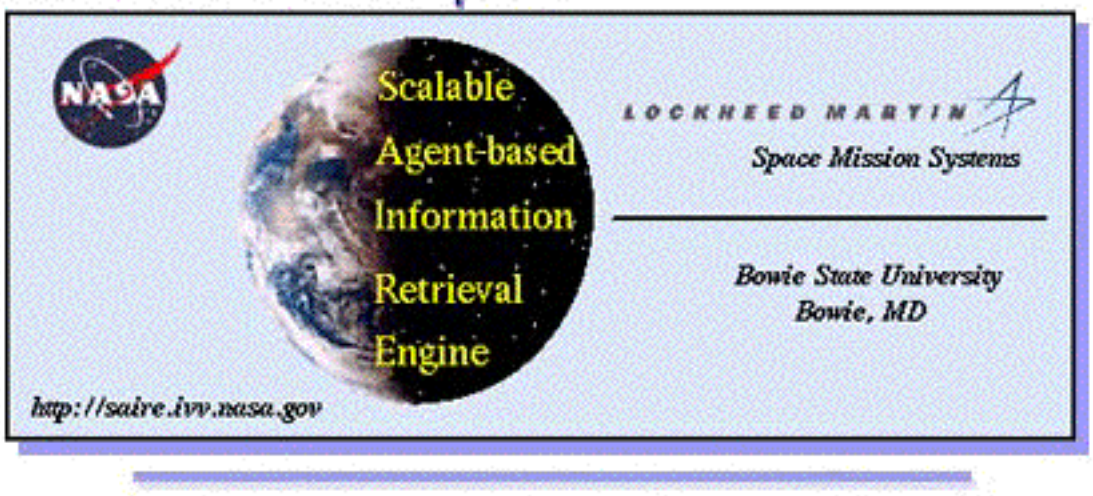

http://saire.ivv.nasa.gov/saire.html

Objective

The goal of the Scalable Agent-based Information Retrieval Engine (SAIRE) project is to develop software tools which incorporate intelligent methods in support of public access of Earth and space science data over the Internet.

Approach

Develop and deploy SAIRE as a multiagent search engine employing intelligent software agents, natural language (NL) understanding, and conceptual search techniques. The agents used in SAIRE are varied depending on the nature of their work (e.g., mediator, collector, user interface, user modeling, concept search). They must collaborate and communicate with each other to support the complex process of information retrieval.

Significance

Demonstrates a technology for simplifying access to NASA and NOAA data sets when information sources are heterogeneous and distributed over the Internet.

SAIRE's multiagent search engine and user interface capabilities received attention from several DLT projects and can be used to build similar capabilities for any other search engine.

Point of Contact

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Accomplishments

Accepts user queries in an NL format with approximately 11,000 words and 7,000 phrases in its Earth science dictionary, and retrieves information from distributed and heterogeneous data sources such as Global Change Master Directory (GCMD), Distributed Active Archive Center (DAAC) of NASA, and NOAA, in response to a single NL query. SAIRE supports online tutorial and user interface on the status of user queries.

Provides nine agent groups that communicate and collaborate to properly satisfy user interests. The User Modeling Agent (UMA) provides a capability to group users based on their interests, and dynamically classifies them in various groups based on their query activities.

Supports long sessions where users can log off after entering a query. Results of a query, including metadata and information about browse data, are e-mailed to users at a later time. As new information is collected, SAIRE can notify users with similar interests about this new information via e-mail.

Demonstrated SAIRE at the ACM conference on Autonomous Agents (AA'97), the NASA DLT workshop, and the NASA MUSPIN'97 conference.

Plans

Develop capabilities for the Concept Search Agent (CSA) to dynamically build concept relationships in a semantic net as information is retrieved. Interact with UMA to help users explore related concepts, perform concept-directed searches, and build more exact queries when query words are insufficient to search the database.

Develop a generic version of the SAIRE system (e.g., a SAIRE template) that can be used to build SAIRE-like applications in different domains.

PROJECT HORIZON

Test Applications and Digital Library Technologies in Support of Public Access to Earth and Space Science Data

http://horizon.ncsa.uiuc.edu/

Objective

To enhance WWW client and server technology in support of better public access to Earth and space science data.

Approach

Conduct development work in client- and server-side technology and demonstrate these products through two science testbeds.

Significance

Developed easy-to-use, scalable digital library technologies for the public to use to locate, integrate, access, and analyze Earth and space science data via the Internet.

Horizon is serving scientific data to K-12 classes, as well as the general public and professional scientists.

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Accomplishments

Created new Web technology access, visualization, and analysis using Java -- flexible, customizable, general framework for all kinds of science data.

Serving scientific data over the Internet -- provided effective access to large and complex data sets.

Intelligent searching -- groundbreaking research on concept-based semantic retrieval and semantic indexing.

Implemented two testbeds demonstrating real Earth and space science Horizon testbed servers that provide real Earth and space science to the public.

Space Science Testbed -- The Astronomy Digital Image Library
http://imagelib.ncsa.uiuc.edu/imagelib/

Earth Science Testbed -- The Daily Planet (TM)
http://www.atmos.uiuc.edu/

The Public Connection

EARTH VIEWS OF SPACE **CONNECTED** SPACE VIEWS OF EARTH

Rice University & the Houston Museum of Natural Science

http://space.rice.edu/hmns/
http://spaceupdate.com

Objective

To bring real-time NASA imagery to the general public by means of interactive computerized exhibits in museums and schools, planetarium shows, online Challenger Center simulations, and online "Ask the Scientist" videoconferences.

Approach

This project builds a very important "off-ramp" so that museum visitors and school children can access these wonderful sources of information with no special training - everything is "point and click." The multimedia programming package "Macromedia Director" is being used so that the modules can include QuickTime movies, images, and sound, all with very rapid, user-chosen, access. All modules have imagery updated automatically by "push" technology in the background so that an up-to-date image is always immediately available to the visitor.

Significance

The Public Connection brings the power of the Internet to people without the technical or financial ability to surf on their own, without allowing unlimited access to the often inappropriate material on the Web.

Point of Contact

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Accomplishments

Over 500,000 people have interacted with our six modules at the Houston Museum of Natural Science. "Space Update" highlights all of Earth and space science; "Welcome to Planet Earth" focuses on Earth weather, climate, and resources; "Space Weather" describes the plasma environments of the Earth and planets; "Houston Today" gives the weather from a network of school-based weather stations and allows the visitor to predict the weather; "Astronomy Update" shows the latest imagery from Hubble and ground-based telescopes; and "Solar System Update" provides a tour of the solar system using the latest NASA imagery. "The Sky Tonight" is a dynamic portion of the program which has featured comet Shoemaker-Levy 9, comet Hyakutake, and comet Hale-Bopp, and which will feature monthly star and planet charts for each year's edition of the CD-ROM.

The project has fully-updating modules at several museums and schools, including The Rice K-8 School, Watson Lake Science Center, NASA/Langley, and the Austin Children's Museum. More museums will come online this fall, including the Air Force Academy, Boston Science Museum, and Carnegie Science Center. Our "Weather Watch" software can be tailored to any location with an AWS weather network, and Carnegie will be our first such out-of-town modification. Two computers running the "Space Weather" software are also part of the "Electric Space" exhibit, now on national tour. In addition, the project has supported three planetarium shows, daily Challenger Center simulations, many Internet summer camps, and over sixty "Ask the Scientist" CU-SeeMe videoconferences.

The entire "Space Update" software suite is available on CD-ROM in Macintosh, Windows, and museum (two-screen) versions. Over 400 copies have been distributed to teachers and museums for testing and evaluation, and a major CD burn is being planned.

Plans

This project's funding expires in Fiscal Year 1998, but the project will continue as long as possible using revenues from CD-ROM sales and downloading services. Spitz Inc. is distributing our planetarium shows "Destination: Mars" and "Northern Lights." We will provide some outreach services for the NASA "IMAGE" mission (to be launched in January 2000).

NSF-DARPA-NASA Digital Library
Joint Research Initiative

NASA seeks to develop and demonstrate technologies needed to build digital libraries to electronically access NASA science data. NASA has pursued this goal through a mix of focused efforts it directly funds, as well as by participating in a collaborative inter-agency effort addressing fundamental cross-cutting technology issues.

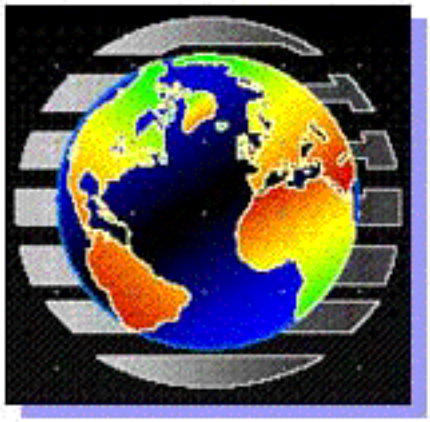
Through the Digital Library Joint Research Initiative, NASA jointly co-funds, with the National Science Foundation (NSF) and the Defense Advanced Research Projects Agency (DARPA), six research and development projects. This four-year, multiagency effort was initiated in 1994 and continues through 1998.

Interoperability

Alexandria Digital Library - UC Santa Barbara
Electronic Environmental Library Project - UC Berkeley
Stanford Digital Library Project - Stanford University

Search

Informedia Digital Video Library - Carnegie Mellon University
University of Illinois Digital Library Initiative - University of Illinois
University of Michigan Digital Library Project - University of Michigan



Alexandria Digital Library

http://alexandria.sdc.ucsb.edu

Objective

A distributed digital library supporting: (1) access to maps, images, aerial photos, text, and other materials by geographical reference; (2) work-spaces for the manipulation of such information.

Approach

Develop components of a distributed digital library, including collections, catalogs, interfaces, and ingest facilities, using emerging Internet technologies.

Provide simple Java-based interfaces for users and support interoperability with other Internet-based information environments.

Extend current catalog and metadata models, emphasizing standards such as USMARC and FGDC, and special gazetteer and thesaurus services.

Develop content-based access methods for maps and images using image processing technology and visual thesauruses, and progressive delivery of large items using wavelet technology.

Use parallel processing and client-server load balancing techniques for optimized server performance.

Accomplishments

The Alexandria project has developed a distributed testbed, with a clone at SDSC, for evaluating research in usability, interface databases, image processing, and parallel processing. The project has also built an operational digital library, available to students and faculty of the University of California as of November 1997.

Significance

This project has built a digital library that supports geospatial access based on many areas of current research.

Plans

Although this agreement expires in Fiscal Year 1998, the project has plans for major extensions of its research and development activities.

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Objective

To develop technologies that support "work-centered" digital library services oriented to address the mission of the work group.

Approach

Create a digital library testbed of California environmental information consisting of diverse materials that include textual documents, photo images, and various kinds of map data.

Significance

This project is exploring real implementation issues involved in creating terabyte-sized environmental information digital libraries comprised of diverse materials ranging from textual documents to photo images to map-oriented data.

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Accomplishments

The testbed currently holds 200,000 pages of text from 1,900 documents, as well as 900 aerial photos, 55,000 ground photos, 100 digital orthophotoquads, and 200 digitized USGS topographic maps.

Produced content-based image retrieval and classification algorithms for the testbed based upon coherent regions of color and texture.

Developed a novel "Multivalent" model of digital documents (i.e., a network-centric model of documents that is radically open, radically distributed, and radically extensible).

Developed a Java-based geographic data browser for accessing and displaying multiple layers of geo-referenced data interactively.

Built a prototype system that automatically classifies text documents based on content, and which can retrieve documents based on word-senses.

Plans

This agreement expires in Fiscal Year 1998.

Stanford Digital Library Project

http://www-diglib.stanford.edu/diglib/pub

Objective

To enhance accessibility to and interoperability among distributed information repositories through development of a virtual software bus, InfoBus, which will transparently translate formats, broker services, and support financial transactions.

Significance

Interoperability issues are generic challenges to all digital library systems. Solutions developed here will have broad applicability to other systems.

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Accomplishments

Building a distributed testbed consisting of computing literature sources and information processing resources. Information sources include Knight-Ridder's Dialog service, the World Wide Web, the Library of Congress catalog, a geographic information system, and Stanford's libraries. Remotely usable services include document summarization, bibliography preparation, and OCR.

Developing interfaces which permit users to interact with many repositories without having to be aware of differences, such as the query format requirements of each individual repository. Other interfaces enable integrated result set exploration.

Developing a metadata architecture that allows online services to interact with repositories, and that allows user interfaces to provide better guidance for users. For example, the architecture provides for components that contain all information necessary for a query translator. It also includes components for translating among multiple attribute sets.

Designing and building a prototype mechanism (InterPay II) for interacting with many emerging electronic commerce schemes. In contrast to InterPay I, this design and prototype enables interaction among components that not only differ in payment scheme, but also in interaction model. The prototype can, for example, act as mediator for dealing with services that require payment before delivering functionality or documents, but also with services that operate under a subscription model. The difference is made transparent to the client backend software.

We continued work on our SONIA clustering service. This service takes a set of documents and clusters them through various algorithms. SONIA is now tightly integrated with our SenseMaker system. We also integrated the AutoClass clustering algorithm into SONIA and added a number of algorithmic extensions to the SONIA implementation.

For more information, see our reports page at http://Walrus.Stanford.EDU/diglib/pub/reports/annuals/.

Plans

This agreement expires in Fiscal Year 1998.

IITA 1997 Annual Report
Informedia Digital Video Library
Carnegie Mellon University

http://www.informedia.cs.cmu.edu

Objective

Establish a large, online digital video library featuring full content- and knowledge-based search and retrieval.

Approach

Utilizes several techniques for content-based searching and video sequence retrieval. Video content is conveyed in both the narrative (speech and language) and the image. Through the collaborative interpretation and interaction of image, speech, and natural language technology, diverse video collections can be successfully populated, segmented, indexed, and searched with satisfactory recall and precision.

Significance

This project has developed tools for automatic motion video ingest, segmentation, keyword index compilation, and dynamic natural language query and display. This technology is very applicable to the television industry and any other groups that routinely manage large video archives.

Point of Contact

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Accomplishments

Built testbed of over 1,000 hours of digital video, audio, images, text, and other related materials consisting of science documentaries and lectures and broadcast news content.

Automatic transcript generation for indexing.

Developed process for "video skimming," using language and image understanding techniques, that preserves video content while significantly reducing the amount of material to be reviewed.

Addressed issues pertinent to commercial partners, such as network billing, variable pricing, and access control.

Explored performance issues related to Web access and interoperability with other digital libraries.

Developed an optical character reader for video data (Video OCR). Used with Name-It, Informedia's face-name association component, automatic name recognition can be significantly improved.

Plans

This agreement expires in Fiscal Year 1998.

University of Illinois at Urbana-Champaign Desktop LInk to Virtual Engineering Resources

http://www.grainger.uiuc.edu/dli

Objective

The Digital Libraries Initiative (DLI) project at the University of Illinois at Urbana-Champaign is developing the information infrastructure to effectively search technical documents on the Internet. We have constructed a database of full-text journal articles, obtained in SGML format direct from academic publishers in engineering, physics, and computer science. We are evaluating its effectiveness under significant use and researching enhanced search technology.

Approach

The testbed efforts include obtaining SGML versions of journal articles in a direct pipeline from major publishers in engineering and science, then indexing these into a single federated (merged and mapped) collection which can be searched and displayed using the structure of the documents. The large-scale testbed is operational within the context of a major engineering library and integrated with its other online services as a production facility. The Internet client supports multiple views into term suggestion and full-text search indexes, with a transparent drag-and-drop interface between indexes. The term suggestion indexes are used to locate appropriate terms to search for in the full-text indexes. The suggestors use concept space indexes generated by the research. The full-text indexes are network connections to the testbed above. The research efforts are developing automatic indexing technology for the content of documents instead of the structure. In particular, they are investigating vocabulary switching across subject domains in engineering and science by computing concept spaces on large document collections using supercomputers. The protocols for concept spaces are also being embedded as the fundamental infrastructure of a new network information system, called the Interspace environment, which supports information analysis by correlation across repositories.The evaluation efforts study the users and usages of the technology developed above with a variety of methodological techniques. Usability studies using the developed clients are done on sample populations. Contextual investigations study the total information usage of the user population beyond the text documents supported in the testbed. Large-scale user studies, when the clients are propagated around university campuses, utilize instrumentation and surveys.

Plans

The final phase of the design and implementation of the Internet client has been completed. UIUC campuswide distribution of the client will commence October 15, 1997. The testbed currently contains over 30,000 articles from fifty-four journal titles.

Testbed: expanded depth and breadth of coverage in collection. This will include two to three years of electrical engineering (IEE) and civil engineering (ASCE) journals, plus more physics (AIP), computer science (IEEE CS), aerospace engineering (AIAA), and possibly optical science (OSA) and mechanical engineering (ASME). Availability through the Ovid server of complete Inspec and Compendex abstracts will supplement the breadth of full text. A low-end Web version will search these repositories from within the browser.

Internet: prototype multiple view client will become a usable system via connection to production testbed databases. Term suggestion will include an Inspec subject thesaurus. Concept spaces and full-text search will be available for Inspec abstracts (via Z39.50 connection to Ovid server) and for SGML articles (via socket connection to Opentext server). Visual Basic Windows PC version available for limited distribution.

Research: vocabulary switching experiments on documents (concept spaces across subject domains) using large collections generated in engineering disciplines. Multimedia semantic retrieval evaluated on images (textures within maps) linked to text (phrases within documents), in collaboration with UCSB DLI project.

Evaluation: large-scale usage study based on transaction log instrumentation of Web testbed client. Small-scale usability studies on novel functionality of Internet client. Contextual ethnographic studies of information usage in engineering labs.

Publishers: annual partner workshop to discuss collaborations and technology transfer.

Point of Contact

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http://www.si.umich.edu/UMDL/

Objective

Provide digital information collections and services for research, education, and commerce. The objective is to define, implement, and evaluate, in selected user environments, an architecture for federating a large collection of heterogeneous digital information resources that are both physically and organizationally distributed. Our goal is to show also that the inherently decentralized information economy that the UMDL architecture encourages will lead to capabilities beyond the reach of centralized approaches.

Approach

Design and deploy an open, distributed system architecture where interacting software agents dynamically form teams to cooperate and compete to provide library services and perform complex library tasks.

Deployment of the UMDL in middle and high school classrooms provides a context for the design of specialized agent services and appropriate user interfaces, and supports authentic "inquiry-based" approaches to science education.

Significance

This project focuses on combining traditional notions of libraries with contemporary technical capabilities (such as the World Wide Web) in education, where libraries have stressed service, organization, and centralization, and the World Wide Web, which embodies flexibility, rapid evolution, and decentralization.

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Accomplishments

Implementation of market facilitators, integration with a set of UMDL agents, and development of a language to allow agents to describe goods. This goal required that a group of UMDL agents engage the market facilitators to clear prices for a set of goods.

We now have a prototype digital library founded on the concept of information economy. The information economy agents allocate information services efficiently (based on the microeconomics principle of matching supply and demand) and spawn or remove copies of services as user demand varies.

Development of search and retrieval capabilities, including the interoperability protocol we developed with Stanford, for the user interface agent to send queries and receive results from the collection interface agent.

Developed Webbook agents which not only index pages sent to them, but also have a gathering function which identifies the tree of pages associated with a particular homepage URL, thus creating a Web document and then indexing all pages as a single entity. The user interface is able to present concise, grouped information of multiple hits from the same document.

Plans

Transition the mechanisms developed in the research testbed which structure and maintain the user's information preferences into the deployed UMDL system.

Make improvements in the UMDL agent-building toolkit to simplify the task of building agents that are compliant with the UMDL agent architecture.

Continue development of prototype advanced interfaces.

This agreement expires in Fiscal Year 1998.

Education

Objectives

- Develop affordable, innovative K-12 projects, technologies, and applications that can be widely disseminated to the educational community.
- Use NASA activities to inspire students to undertake high-technology careers using the Internet.
- Integrate network and computer literacy into the teaching process.
- Develop Internet-based curriculum enhancements tied to NASA information of interest to teachers and students.
- Develop projects focused on early levels of education and underserved students.

Approach

IITA's Education Project maintains three initiatives:

- K-12 Outreach: NASA center-based activities carried out at seven NASA facilities.
- Aeronautics Education: Cooperative agreements in K-14 aeronautics education.
- Educational Applications of Remote Sensing Data: Cooperative agreements developed under the Public Use of Remote Sensing Data initiative. See pages **4-24.**

Point of Contact for K-12 Outreach Education Projects

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K-12 Outreach

NASA in-house outreach activities.

Grades K-12

- Affordable networking technologies
  - **Langley Research Center**
  - **Johnson Space Center**
- Inspiring students
  - **Ames Research Center K-12 Internet Initiative**
- Network and computer literacy
  (*All projects focus on this to some extent.*)
  - **Lewis Research Center K-12**
- Internet-based curriculum enhancement
  - **Dryden Flight Research Center**
  - **Goddard Space Flight Center K-12** - Earth System Science Education Project
  - **Jet Propulsion Laboratory**
    The JPL K-12 Outreach Project consists of two efforts:
    - **Telescopes In Education**
    - **Project SPACE**

http://k12unix.larc.nasa.gov/

Objective

To enhance and expand the learning opportunities available in our nation's classrooms by developing innovative solutions to technology barriers and by collaborating with K-12 educators to bring the unique NASA experience into the classroom.

Approach

Explore innovative methods which place today's computational and communications technologies into classrooms.

Through the innovative development and use of technology, enable classrooms to understand and become a part of the science and research conducted by NASA.

Significance

Technologies and resources developed by the LaRC LTP are enabling teachers and students to become aware of and make use of the ongoing efforts of NASA scientists and engineers in aeronautics and space.

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Accomplishments

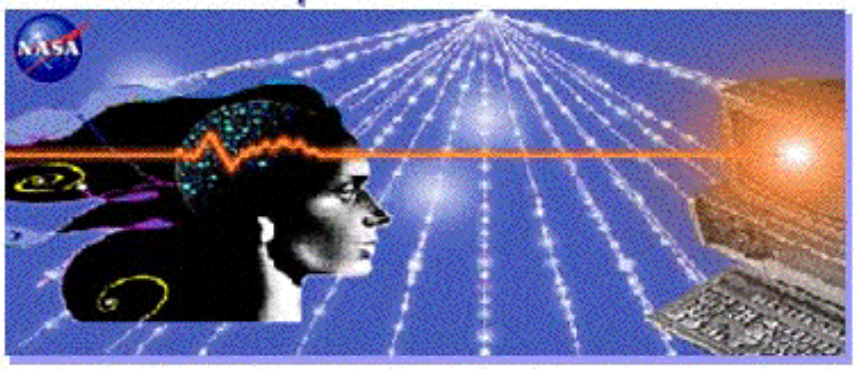
Distance Learning: A prototype version of Java-based classroom feedback software has been developed which allows a remote classroom or classrooms to communicate with a distance learning instructor via the Internet. Class broadcasts can occur through more traditional mechanisms (broadcast TV, videoconferencing, etc.) and participants can provide feedback on the class content and pace via a standard Web browser, allowing the instructor to modify content delivery accordingly.

Online Resources: Off to a Flying Start has been developed as an interactive, aeronautics-intensive, collaborative project for K-4 students. Focusing on science and math, this is the first of several online, classroom-ready projects.

Partnerships: LaRC has formal partnerships in place with the U.S. Department of Housing and Urban Development (HUD) as part of HUD's Neighborhood Networks initiative, the Network Resource and Training Site at Elizabeth City State University in support of its outreach to other historically black and minority educational institutions, and one software development firm developing a commercial version of a LaRC networking model.

Plans

The LaRC team's efforts for Fiscal Year 1998 will focus on the development of affordable networking technologies and improvement of the distance learning process. Internet-based distance learning mechanisms will be used to connect NASA LaRC researchers with classrooms across the state and beyond.



NASA JSC K-12 Learning Technologies Project

http://www.jsc.nasa.gov/stb/ltp.html

Objective

To provide affordable networking technology that enriches the K-12 education process.

To share NASA knowledge with K-12 educators, students, and the public.

Approach

Provide equitable electronic access to Internet resources through advanced communications technology.

Couple NASA content resources with electronic access and network tools.

Significance

The use of simple, affordable networking tools in everyday teacher routines and classroom activities is an active vehicle for integrating electronic resources and disseminating NASA science information within the K-12 environment.

Related Information

The JSC Learning Technologies Home Page
The ILIAD Home Page
The SIMON Home Page

Accomplishments

SIMON: Developed the School Internet Manager Over Networks, which provides affordable Internet connectivity, smart searching, an automatic lesson builder, and a lesson library for K-12 teachers and students. Conducted lectures and hands-on demos at local and regional workshops and conferences. Beta - June '97, production - Sept. '97.

ILIAD: Continued to support ILIAD, an offline, e-mail Web agent that serves vision-impaired computer users and teachers who have minimal computing resources.

Accomplishments (cont.)

The Texas Education Network (TENET) continues as our collaborative partner, statewide installation site of ILIAD, and dissemination site of SIMON.

Technology Transfer: Submitted a NASA Technology Disclosure of SIMON to the JSC Technology Utilization Office. Transferred a copy of ILIAD to the Research, Rehabilitation, and Training Center (RRTC) for Blindness and Low Vision at Mississippi State University.

Sharing NASA: Collaborated with the Ames K-12 Sharing NASA project "Shuttle Team Online." Provided forty-five volunteers to write biographies and journals, answer e-mail questions, and participate in live Webchats.

Plans

Continue the development of affordable networking technologies. Plans include enhancements of SIMON based on teacher requests submitted during the SIMON beta testing cycle. Additionally, we will continue to disseminate SIMON through TENET via the Master Trainer program, workshops, and the TENET Web.

Our collaborative partnership with the Ames K-12 Sharing NASA project "Shuttle Team Online" will continue and expand to include space station personnel and activities.

Combine network technology and NASA content in a dynamic, interactive game forum to showcase NASA science and engineering online information.

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The Quest Project

NASA's K-12 Internet Initiative

http://quest.arc.nasa.gov

Objectives

Use NASA activities to inspire students, via the Internet, to better understand science and pursue high-tech careers.

Integrate network and computer literacy into the teaching process.

Help NASA Enterprises communicate knowledge to schools.

Approach

Conduct online, interactive projects which allow students to meet the people of NASA and share in the excitement of authentic scientific and engineering pursuits.

Provide educators and the general public with a location on the Internet that allows them to participate in online courses and to remotely attend some NASA workshops and seminars.

Significance

This project inspires students and helps teachers make effective use of the Internet. Another result is an increased public awareness and support for NASA activities.

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Accomplishments

Instructional Materials to Inspire Students: Developed Sharing NASA projects that use the Internet to connect students in an exciting, interactive way with NASA scientists and engineers. Projects include lesson plans and student activities.

Virtual Conferences and Courses: In 1997 the Ames K-12 team used text, graphics, audio, and video technologies over the Internet to enable individuals to "virtually" attend the NetDay96 Virtual Conference, the Silver Anniversary of Pioneer 10, and a telerobotics course offered for credit through the University of North Dakota.

Information Delivered: Quest, the Ames K-12 server, hosts Sharing NASA and Virtual Conference activities and also delivers a wealth of resources, including grant information, to educators who want to get connected to and use the Internet in the classroom. By the end of Fiscal Year 1997 it was receiving over 1.5 million hits per month from 100,000 unique IP addresses, including 4 million hits in July with the landing of Mars Pathfinder. Access continues to grow.

Conference Outreach: Participated in approximately one dozen conferences and speaking engagements in Fiscal Year 1997.

Plans

In Fiscal Year 1998 the Ames K-12 team will continue its Sharing NASA efforts with "Aero Design Team Online," "NeurOn," and continuations of "Live From Mars" (a collaboration with PTK, NSF, and PBS), "Shuttle Team Online," and "Women of NASA." It will also launch the Learning Technologies Channel, which will use virtual conference technologies to Webcast events such as the US Department of Education's Satellite Town Meetings and a weekly "Teaching with the Internet" series.

NASA Lewis K-12 Program

http://www.lerc.nasa.gov/WWW/K-12

Objective

To realize an overwhelming presence of computer and communications equipment within K-12 schools and to have that equipment used regularly and automatically as a tool within math and science classes.

Approach

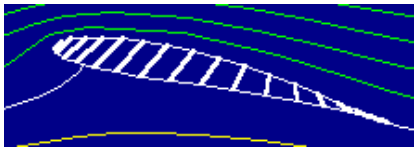
Conduct teacher training on computer technology and applications appropriate for an educational setting. Develop educational material which is available on the Web and can be used as a supplement in math and science classes.

Significance

The target audience of the project is K-12 teachers and students nationwide. Within these states, schools of diverse backgrounds are targeted so that as many students as possible can be reached.

Additional Web Pages

Foil Sim Web Page
http://www.lerc.nasa.gov/WWW/K-12/aerosim



Classroom of Excellence Web Page
http://www.lerc.nasa.gov/WWW/K-12/CoE/COEmain.html

Accomplishments

Foil Sim:
Foil Sim is an educational software package which simulates air flowing over a baseball and an airfoil. An output graph located next to the simulation graphs pressure, velocity, and other parameters. Slider bars included in the package allow the user to change various aspects of the airfoil, such as angle of attack, thickness, camber, and velocity. The baseball simulator allows the user to throw a curve ball or a screwball and to notice the air pressure differences associated with those throws and a fastball.

Accomplishments (cont.)

Regional Summer Computer Workshops:
Three two-week computer workshops were held during the summer, one each for the high school, middle school, and elementary school levels. Teachers who participated in the workshops received intensive hands-on computer training during the first week. They then created classroom lessons or activities during the second week. These are displayed on the NASA Lewis LTP Web server.

Classroom of Excellence Classes:
From October '96 through September '97 the NASA Lewis LTP conducted training classes in the Classroom of Excellence for 1,104 teachers. The room was also used by other trainers from other organizations to train teachers. Additionally, 178 students have received training in the CoE.

Plans

The NASA Lewis Learning Technologies Project (LTP) plans to continue development of educational software. In 1998 Engine Sim will be introduced. Foil Sim and Aeronauts 2000 will be tested in the classroom. The LeRC LTP will also prototype two networking solutions within schools to evaluate their effectiveness in providing access to the Internet. The LeRC LTP will participate in the NASA Learning Technologies Channel program by providing teacher training on the use of our software via videoconferencing.

Point of Contact

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NASA Dryden Flight Research Center Learning Technologies Project

Web-Enhanced Learning Environments: Analysis, Teacher Needs Assessment & Design

The Dryden Learning Technologies Project is a collaboration between Dryden Flight Research Center and the Pennsylvania State University. The multiyear research project began with an analysis and teacher needs assessment relative to the effective use of the Internet and the World Wide Web in the classroom. During the summer of 1997, two teacher focus groups were conducted on the use of Web-Enhanced Learning Environment Strategies (WELES); one at Langley Research Center and one at Dryden Flight Research Center. During the focus groups, teachers were asked to evaluate and critique the WELES to improve their design. Two Learning Technologies conferences were planned to study best practices for delivering instruction via the World Wide Web and to evaluate how effectively NASA-sponsored Aeronautics Cooperative Agreements were meeting the needs of their K-12 customers. The latter conferences were attended by the Aeronautics Cooperative Agreement team members, representatives from NASA Headquarters, the four aeronautics centers (Ames, Dryden, Langley, and Lewis), the University of Idaho, and the Pennsylvania State University. The research project will culminate with an impact study of systemic reform of teaching practices in K-12 classrooms as a consequence of Web-based instructional sites. The impact of NASA's Learning Technologies Projects on K-12 instruction and systemic reform of teaching practices will be central to the project.

Objectives

The DFRC Learning Technologies Project is dedicated to providing a comprehensive examination of the impact of the World Wide Web on classroom instruction. The purpose of the study is to ensure that NASA's Learning Technologies Projects:

- adequately serve the K-12 community
- are utilized consistently in K-12 classrooms
- inspire students to study science, mathematics, and technology using NASA mission-specific activities
- assist students in the development of technical competence and literacy
- promote excellence in America's educational system

Approach

Conduct an analysis of current teacher needs, school technology infrastructure, and exemplary instructional Web sites.

Develop models of Web-enhanced Learning Environment Strategies (WELES) which incorporate sound instruction design, demonstrate methods of integrating the WWW into the classroom, and address access limitations and different teacher and learning styles.

Conduct teacher focus groups to identify needs and obtain feedback on models of Web-enhanced Learning Environment Strategies.

Significance

The needs assessment yielded useful insights about K-12 customer needs with regard to using NASA Web-based materials and technologies in the classroom. The WELES are still undergoing revision based on teacher feedback. At this phase of the research, the WELES are models without specific NASA content. As the WELES evolve into a form that meets the teachers' needs, specific examples with NASA content can be developed and tested during the impact study. The purpose of the research is to understand the actual utility and application of our current products in the K-12 classroom, to devise methods and strategies which encourage teacher use of NASA Learning Technologies products, and create strategies for NASA developers to employ which more precisely meet their customers' needs.

Accomplishments

Completed analysis and needs assessment report.

Developed six models of Web-Enhanced Learning Environment Strategies.

Conducted two teacher focus groups to evaluate WELES.

Conducted a March Learning Technologies conference to study best practices for delivering instruction via the World Wide Web

Plans

Continue to refine WELES.

Identify three teams (K-4, 5-8, 9-12) of five teachers each for pilot tests.

-Continued on Page 57-

Web-Enhanced Learning Environments: Analysis, Teacher Needs Assessment & Design

Plans (cont.)

Develop WELES with NASA content as examples.

Develop assessment tools for data collection during the pilot testing phase.

Develop fall impact study (large group field test).

Share research findings with Learning Technologies Project management, Headquarters Educational Technology management, other participants in the research process, the educational community, and the public.

Point of Contact

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Goddard Space Flight Center Earth System Science Education Project

http://hpcc-k12.gsfc.nasa.gov/gessep/

Objective

To integrate real-time NASA data into secondary school Earth and environmental science education through the development and dissemination of Internet-based learning investigations.

Approach

Twenty of the sixty-five Earth science teachers trained through the Maryland Earth and Environmental Science Teacher Program were selected to participate in a four-week summer institute at GSFC to develop Internet-based Earth and environmental science learning investigations for grades 5-8 and 9-12. Each investigation focused on two or more of the following Mission to Planet Earth science areas: hydrosphere, atmosphere, lithosphere, and biosphere, and incorporated NASA (and other government and academic) science data.

The investigations were validated for content by MTPE scientists and disseminated via the World Wide Web for pilot testing. Each investigation was self-explanatory and included a user evaluation form.

Accomplishments

Teachers developed forty-three Internet-based Earth and environmental science learning investigations which meet national standards for science, mathematics, and geography education. The investigations have been validated for content by MTPE scientists and converted to HTML format following a standardized template.

LTP staff developed an evaluation tool and appended it to each investigation to capture user feedback.

This activity was identified as the most valuable GSFC MTPE education activity of Fiscal Year 1997. Consequently, near-term launch missions such as TRMM have approached the project to develop investigations incorporating their data as it becomes available.

Plans

Investigations will be pilot tested and evaluation feedback will be used to improve them. The number of investigations (and science areas addressed) will be augmented in Fiscal Year 1998.

Significance

This project is the only activity within NASA that addresses all four of NASA's program objectives defined in the Strategic Plan for Education. It is also the first effort to produce Internet-based MTPE educational products to bring NASA data into the classroom.

Point of Contact

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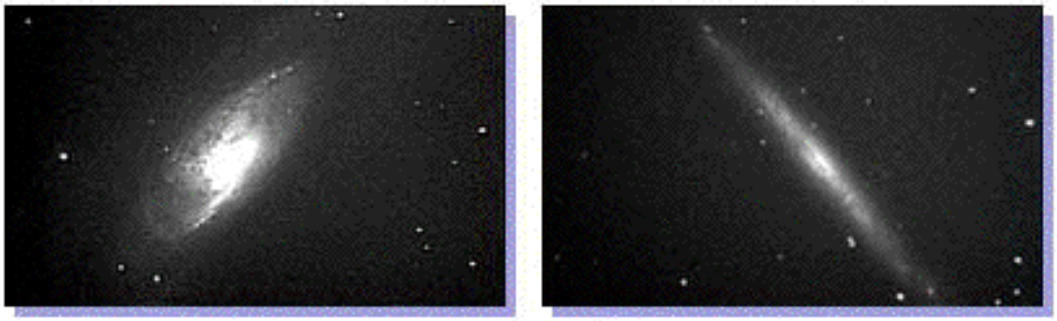
Related Information

For information about related activities see http://hpcc-k12.gsfc.nasa.gov/.

JPL K-12 Outreach Project



Telescopes In Education

http://tie.mtwilson.edu

Objective

Enable students to increase their knowledge of astronomy, astrophysics, and mathematics; improve their computer literacy; and strengthen their critical thinking skills.

Approach

The Telescopes In Education (TIE) program brings the opportunity to use a remotely controlled telescope and charge-coupled device (CCD) camera in a real-time, hands-on, interactive environment to students around the world through a computer in each classroom.

Significance

The Telescopes In Education project provides the opportunity for K-12 students to conduct real astronomy research through the remote operation of professional-quality telescopes. TIE is of particular value to special student populations who have a historical lack of access to positive science experiences, such as physically disabled students, minority and female students, and school populations from economically disadvantaged, crowded inner city, and isolated rural areas.

Accomplishments

- TIE continues to enable educators and students to operate professional telescopes and download photos of celestial objects from the convenience of a computer in their classrooms.
- Several substantial improvements have been made in 1997 to the automated telescope system in Mount Wilson, California.
  - On the 24" reflecting telescope: the mirror was realuminized, a higher quality secondary mirror was installed, the telescope drive system was improved, and the hard drive in the system computer was upgraded.

Accomplishments (cont.)

  - An 80mm guide telescope with an ST 4 CCD camera was installed on the 24" reflecting telescope to provide more accurate tracking.
  - A 6" refracting telescope and ST 8 CCD camera were attached "piggyback" to the 24" reflecting telescope to provide remote planetary imaging capability.
  - Installed UBVRI filters to enable remote color imaging.

- Version 2 of the TIE User's Guide and Workbook was produced.

- Remote astronomy training workshops were conducted for K-12 teachers.

- Implementation was begun on project SCHOLAR (Students Conducting Hands-On Learning in Astronomy Research). Through SCHOLAR students will participate in actual research sponsored by professional astronomers and TIE.

- Numerous articles were published about TIE (including *Astronomy, Boys Life, HPCC INSIGHTS, Sky and Telescope*, and *Space Microelectronics*). TIE was featured on the NBC Nightly News, the NBC Super Channel, MSNBC, United Airlines Programs, and other broadcast media.

Plans

TIE will continue to meet the needs of educators and students who wish to conduct research in astronomy and astrophysics via the use of remotely controlled telescopes.

Point of Contact

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PROJECT SPACE
SUN PLANETS ASTEROIDS COMETS EXPLORATION
NASA Jet Propulsion Laboratory

http://learn.jpl.nasa.gov/ProjectSPACE

Objectives

To create, develop, evaluate, and disseminate Web site educational resources and activities, and teacher in-services based on the science, technology, and data derived from the NASA Mission Strategic Enterprises: Space Science, Human Exploration and Development of Space, and Mission to Planet Earth.

Approach

The Project SPACE program integrates advanced computer technology, complex scientific data sets, and a variety of scientific technologies into educational resources, models, simulations, and classroom activities that support the national reform efforts in science and mathematics education.

Significance

The Project SPACE program has developed educational resource products and models which promote and support new methods of science and mathematics education, as identified by national standards, benchmarks, and state frameworks. These products demonstrate how data and information from NASA's projects and programs can be integrated into curriculum models.

Accomplishments

- Twelve new classroom activities and related content resource products were added to the Project SPACE Web site.

Accomplishments (cont.)

- Six teacher in-service workshops and specialty in-services were conducted in cooperation with partnering school districts and educational institutions.
- Attended four national education conferences. Program resource products were demonstrated and disseminated.
- Many thousands of teachers/students used the Project SPACE "Learn" homepage (http://learn.jpl.nasa.gov).
- Educators and students from twenty-one school districts participated in the testing and evaluation of resource products.

Plans

New interactive Web site activities and content will be produced and tested to see how evolving Internet technologies and novel aspects of Web site interactivity can be utilized in the classroom. Will provide an Educator In-service Program that utilizes LTP products, models, resources, and educational methodologies.

Point of Contact

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Aeronautics Education in Grades K-14 Using the Internet

Grades K-6

PlaneMath: Internet-based Curriculum on Math and Aeronautics for Children with Physical Disabilities - InfoUse

LDAPS: LEGO Data Acquisition and Prototyping System - Tufts University

Grades K-8

K8AIT: K-8 Aeronautics Internet Textbook - Cislunar Aerospace, Inc.

Grades K-12

SHAPE: SHaring Aeronautics Projects Electronically - Antelope Valley Union High School District

Grades 6-12

Take Off! Aeronautics and Aviation Science Careers and Opportunities - Massachusetts Corporation for Educational Telecommunications

Grades 9-12

Aviation Academy 2000 - Wooddale High School

SPARK: Student Program for Aeronautics Resources and Knowledge - University of Idaho

Grades 4-14

ALLSTAR: Aeronautics Learning Laboratory for Science, Technology, and Research - Florida International University

PLANE Math

http://www.planemath.com

Objective

Cause children to experience excitement and fun and understand the power of mathematics and aeronautics.

Approach

- Provide online lessons which cover National Council of Teachers of Mathematics (NCTM) standards for fourth grade students.
- Build in accessibility for students with disabilities who use adaptive computer equipment.

Accomplishments

- Gained national recognition and use for accessible math materials on the Internet.
- There are now well over 500 Web pages. Accessibility for students with disabilities who may or may not be using adaptive computer equipment is built into the design.
- Posted eleven math lessons which cover NCTM standards for fourth and fifth grade students. Teacher instructions are included for each lesson. Career interviews and offline group activities are provided for each lesson. A matrix of NCTM standards covered (by lesson) is included.
- A registration capability invites teachers to sign up to use the program. Since the end of January, 1997, over 175 schools have signed up, including almost 7,000 students, nearly five percent of whom have a physical disability.
- PlaneMath has received press coverage and many awards, presented at several conferences, and has been represented in ten technical/ professional publications.

Significance

- This is one of only a few IITA projects addressing mathematics education at the K-6 level.

Plans

- Continue online lesson development. This agreement ends in Fiscal Year 1998.

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LDAPS
Science Through Engineering
A Curriculum For K-12
LEGO Data Acquisition and Prototyping System

http://ldaps.ivv.nasa.gov/

Objective

To develop and distribute a methodology for teaching engineering in K-6 using LEGOs and the Internet.

Approach

- Students are given a design problem (e.g., build a plane).
- Teachers are provided with a teaching methodology that connects all science units.
- Students use LEGOs to build engineering designs for testing in student-constructed wind tunnels. Students use the Internet to gather information for solving their problems.

Significance

This project provides a unique hands-on approach to learning backed by a well-defined teaching methodology.

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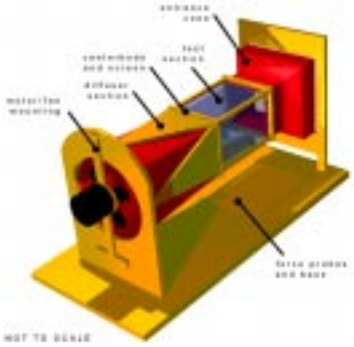
Accomplishments

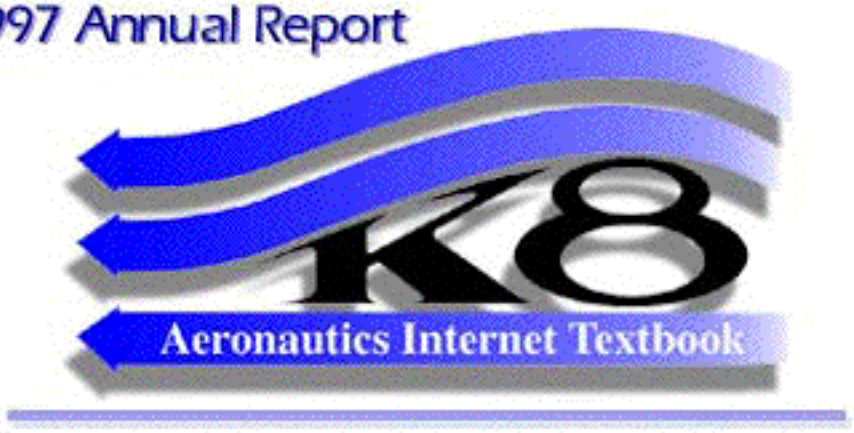
- Developing a sample systemic reform for grades K-3 based on the LDAPS idea in concert with one of the participating schools. This reform would pull engineering into all aspects of learning: from reading and writing to math and science. Further, each year would build off the previous one, giving the students a common thread through the elementary education process.
- Total revamp of Web site - incorporating a number of new curricular ideas, new interdisciplinary units, and easier navigation.
- Total revamp of software - made the interface substantially easier - got kindergartners to program without any problem.
- Ran three summer workshops - now have over fifty teachers at over ten schools across the nation using LDAPS techniques in their schools and generating curricula for the Web site.
- Spread LDAPS ideas and software to over fifty teachers and parents in five continents.

Plans

- A second two-week training class will be held for additional teachers. These teachers will then go on to instruct other teachers in their districts.
- Additional instructional materials will be created and placed on the LDAPS Web site.
- This agreement expires in Fiscal Year 1998.



This is the Baals wind tunnel.
It can be built for under $200.



http://wings.ucdavis.edu

Objective

Develop a K-8th grade aeronautics textbook, teachers' supplement, and student activity workbook which integrates aeronautics as a natural part of Earth, life, and physical sciences.

Approach

- Develop a K-8 Aeronautics Internet Textbook that is an electronic multimedia, interactive application delivered over the Internet via the World Wide Web.
- Introduce the textbook materials into partner schools in New York and California.

Significance

- This project exposes non-traditional audiences to aeronautics concepts.
- This project addresses the needs of teachers who have limited experience in science and no background in aeronautics.
- The lesson plans provide new vocabulary and video instruction in English, Spanish, and sign language.

Accomplishments

- Agreements were made for the acquisition of computer and Internet services to eleven new pilot school sites, including a children's hospital, a school district program for the deaf, and a library system.
- Materials were translated into Spanish.
- Developed over fifty new lesson plans and 500 curriculum bridges to other subjects such as math, social sciences, and literature.
- Added an animated sign language dictionary of science, aeronautics, and flight words. (Not completed.)
- Developed the self-paced Internet training class for educators.
- There was a significant increase in the number and improvement in the quality of animations and videos.
- There was a new emphasis on interactive activities for students. Improvement in the overall appearance of the materials.

Plans

This agreement expires in Fiscal Year 1998.

Point of Contact

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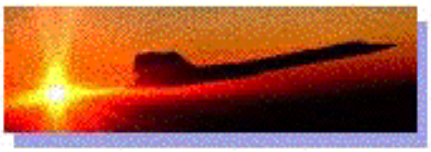
Fax: (707) 255-7215

SHaring Aeronautics Projects Electronically



http://trc.dfrc.nasa.gov/shape

Objective

Interest students in technical careers and develop students' abilities in math and science using aeronautics applications on the World Wide Web.

Approach

SHAPE provides educators with interactive "aeroevents" delivered on the WWW that motivate students to learn math and science at each of the decision points in the event.

Significance

This project uses a hands-on, interactive approach to involve students in an instructional aviation experience.

Point of Contact

Carey Brock, Project Manager
E-mail: brock@trc.dfrc.nasa.gov
Phone: (805) 944-0740
Fax: (805) 944-2982

Accomplishments

- Developed and implemented a model for using the WWW interactively.
- Developed a glider aeroevent teacher tutorial to give teachers basic aeronautical background and to assist teachers with integration of basic aeronautics, math, and science.
- Collaborated with more than 100 educators who are involved with the NASA DFRC's Internet Training Workshops during the summer.

Plans

- Complete F-15 ACTIVE aeroevent teacher tutorial.
- This agreement ends in Fiscal Year 1998.

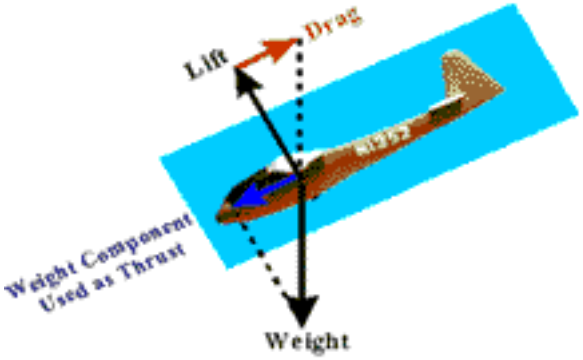
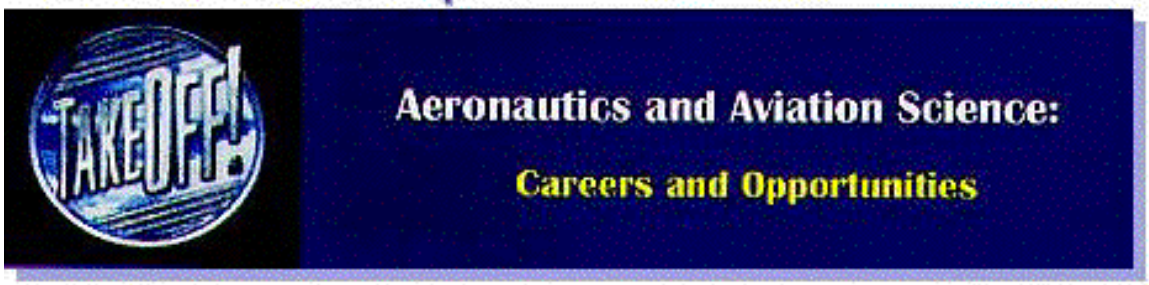


Figure 2: Glider, Steep Flight Path (High Speed)

This is a figure from the Glider Flight Tutorial.



http://www.mcet.edu/nasa

Objective

To engage students in grades 6-12, particularly minorities and females, in new science and mathematics curricula reflecting aviation and aeronautics themes.

Approach

Instruction is delivered using a variety of technologies: interactive live satellite broadcasts, Internet, videoconferencing, and pre-produced videos.

Significance

Young adults, particularly female and minority students, traditionally underrepresented in aviation and aeronautics, will be encouraged to pursue careers in those fields.

Point of Contact

Dr. Francesca Casella
Massachusetts Corporation for Educational Telecommunications
One Kendall Square, Building 1500
Cambridge, MA 02139
E-mail: franc@mcet.edu
Phone:(617) 252-5700 x740
Fax: (617) 252-5718

Accomplishments

Developed, produced, and broadcast the new Take Off! series (grades 9-12). Number of MCET- registered participants to the series: 2,500 nationally.

Take Off! Part II has been enhanced with the addition of a "Career Corner,"; live, interactive interviews with role models representing careers in aviation/aeronautics. The interactive sessions were very much appreciated by the students.

Addition of graphics, animations, and studio demonstrations.

A "Piloting the Web" feature during the live broadcast. The session highlighted many of the outstanding aeronautics Web sites developed through the IITA.

Produced an extensive "Teacher's Resource Guide" in support of the broadcast series. The guide included instructions on the use of the live satellite in the classroom and many innovative aviation-based activities to enhance students' understanding of the underlying math and physics concepts explored in the broadcast.

The Web site has a completely new graphic layout and framed navigation scheme, a newly designed broadcast page, an updated "Activities" page with the inclusion of explanatory diagrams, and downloadable templates.

New pages added: History, divided in two sections -- "Timeline" and "Notable People in Aviation." This new feature contains bibliographical and historical information about aviation pioneers, additional links to activities and lesson plans available on the WWW, and links to aviation virtual museums and sites. A "Career Album" features the profiles of the guests of the Take Off! series and other career representatives available for online interaction with the students. An interactive "Glossary" page provides internal links to graphics and illustrations and external links to sites integrating the content for particular entries.

Plans

This agreement expires in Fiscal Year 1998.

Wooddale High School Aviation Academy 2000

http://www.mecca.org/~tschieff/AVIATION/ACADEMY/

Objective

To increase students' desire to gain a working knowledge of English, mathematics, and science skills by digitally integrating a computerized infrastructure linking core classrooms to the Internet.

Approach

Integrate a computerized infrastructure by linking core classrooms to the Internet. Information collected, assimilated, and categorized will be entered into an aeronautical database to be used by educators and industry.

An Education Partnership of local aviation industry experts supports the thematic curriculum model by providing current resource information and classroom instruction.

Significance

This project has a unique vocational training focus, unlike any other project sponsored by IITA.

Point of Contact

Tom Schieffer
Wooddale High School
Aviation/Travel Program
5151 Scottsdale Avenue
Memphis, TN 38118
E-mail: tschieff@mecca.mecca.org
Phone: (901) 366-2440
Fax: (901) 366-2476

Accomplishments

We are continuing to cross academic barriers through the integration of standard curricula with aviation technology -- virtually unheard of in college prep high schools.

New pages and lesson plans have been incorporated into the Web site.

Completed the second annual Aviation Teacher Training Session, which was highly successful, for training teachers to use their computers and their Internet connections as resources for classroom collaboration.

Sponsored a very popular Aviation Academy where fifty students, during two weeks of intensive one-week sessions, learned about all facets of the aviation industry and even got to pilot a Cessna airplane.

Developed community and business support for the program throughout the aviation industry. We are a highly regarded member of the Memphis Area Aviation Association.

The Wooddale Aviation Program was featured on a nationwide school-based television program. We have been featured on all of the local television channels during the year.

Wooddale High School was honored with a certificate of commendation during a highly publicized hearing at the Memphis City Schools' Awards Board meeting.

The Aviation/Travel and Tourism Marketing Class has six major winners in the manuals competition. Using the experiences gained through exposure to aviation subjects and by using the aviation computers, students were able to win at the regional, state, and national levels.

Plans

Expand online materials.
This agreement expires in Fiscal Year 1998.

Student Program for Aeronautics Resources and Knowledge

http://nasaui.ited.uidaho.edu/

Objective

Enable children to understand the potential that aeronautics holds for humankind.

Approach

SPARK is demonstrating aeronautics curricula with rural, Native American, and disadvantaged youth in Idaho using Design and Inquiry Challenges. These efforts meet local, state, and national standards for grades 9-12.

Accomplishments

- Designing interactive Web pages that require the user to utilize the Internet and classroom manipulatives and return to the Internet to complete the activity (http:/nasaui.ited.uidaho.edu/nasaspark/ datashar.html).
- Provided ten internships for Native American high school students within local aeronautics industries.
- Utilized NASA-provided connectivity to leverage a partnership between Lapwai High School and Hewlett-Packard. This partnership provides equipment, expertise, and mentoring for the school and the students.

Significance

- This project exposes remote rural and Native American students to aeronautics and engineering concepts.

Plans

- Apprenticeships - During the summer of 1998, students will apprentice with Idaho Engineering Laboratories, Idaho Division of Aeronautics, and others. The apprenticeship is designed to bring telecomputing home to rural Idaho.
- This agreement expires in Fiscal Year 1998.

Point of Contact

Kay Brothers, Program Director
University of Idaho
College of Education
Moscow, ID 83844-3080
E-mail: brothers@uidaho.edu
Phone: (208) 885-4028
Fax: (208) 885-7607

Aeronautics Learning Laboratory for Science, Technology and Research (ALLSTAR) Network

http://www.allstar.fiu.edu/

Objective

To significantly increase the number of minorities studying aeronautics in grades 4-14 through outreach, information access, and application components.

Approach

Develop an innovative environment for encouraging minority students to study and pursue the aeronautics discipline.

Develop new courses of instruction and create a rich, new multimedia learning environment for aeronautics.

Accomplishments

Developed over 500 Web pages of text, including audio, photo, and video clips.

Developed a module on aeronautics research at NASA featuring the X-33 space plane.

Developed lesson modules on:

- History of Flight
- Principles of Aeronautics
- Careers in Aeronautics

ALLSTAR operates a Bulletin Board System for aeronautics-related topics. Students' questions are answered by NASA scientists and FIU faculty.

Significance

This project seeks to develop an innovative environment for encouraging minority students to study and pursue B.S., M.S., and Ph.D. degrees in the aeronautics field.

Plans

The ALLSTAR network resides in three high schools of the Dade County Public School System (DCPS) and at the Miami-Dade Community College, the largest minority community college in the country. ALLSTAR will expand to include nine other schools in Dade County.

Point of Contact

Dr. Cesar Levy
Florida International University
Center for Engineering and Applied Science
Mechanical Engineering Department
University Park, Room - EAS 3442
Miami, FL 33174
E-mail: levy@eng.fiu.edu
Phone: (305) 348-3439
Fax: (305) 348-1932

Photo Gallery

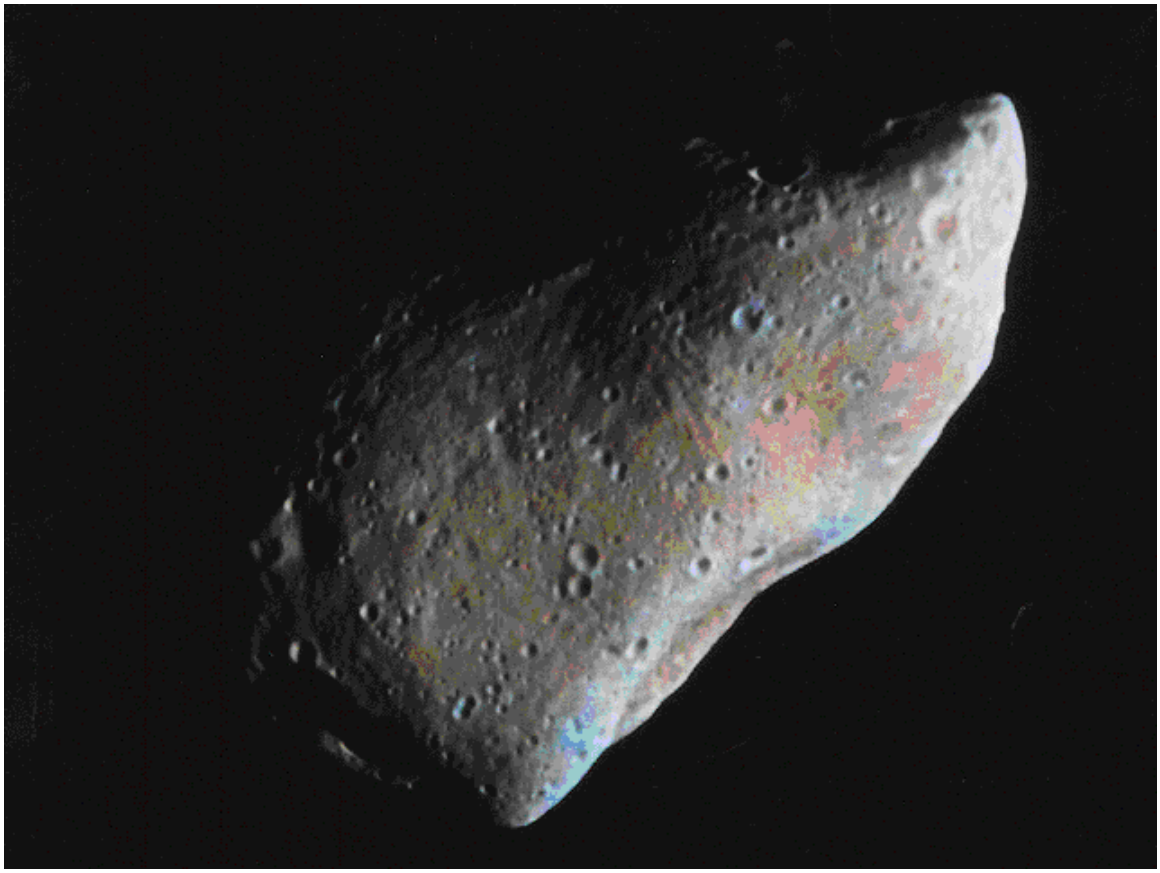
Asteroids: Galileo Image of Gaspra
Auroras from Space
Aviation: Gliders
Classifying Galaxies
Convection on Earth and Other Planets
Creating the Public Connection
Floods: Emergency Response
Forestry: Landsat Archive
Handicapped Youth: Careers in Aviation
Hurricane Fran
Internet Literacy for Teachers
Ocean Soundings: Experiment in a Shoebox
Orbital Mechanics: Do-It-Yourself Simulations
Rainfall Map of United States (updated daily)
Rain Forests: Studying Environmental Change
Remote Sensing Software: Where to Find It
Rockets: The History of Their Development
Space Weather Today
SR-71 -- Speed in the Service of Science
Students Control Mt. Wilson Telescope
Sun in X-ray Image
The Spirit of Inquiry
Tourism: Virtually Hawaii
- **Hawaii from Space**
- **Landsat Image of the Big Island**
- **Aerial View of SE Oahu**

Tsunami - The Big Wave
Volcanoes: What's Erupting Now
Weather Reports: WRC-TV's WeatherNet4
- **Interactive Satellite Image**
- **Wonderful Sunrise**

When to Irrigate
Zoom into a San Francisco Neighborhood

Web page excerpt from Windows to the Universe:

Our Solar System - Asteroids



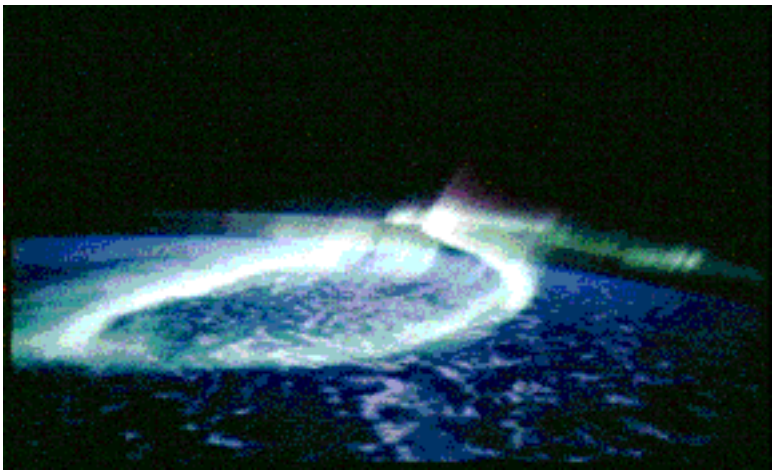
Galileo image of Gaspra
(29 October 1991) courtesy of NASA/JPL

"Asteroids are small bodies that are believed to be left over from the beginning of the solar system 4,600 million years ago. They are rocky objects with strange shapes up to several hundred km across, but most are much smaller.

"Many thousands of asteroids lie in a belt between Mars and Jupiter. Scientists think that this debris may be the remains of an early planet which broke up early in the solar system. Several thousand of the largest asteroids in this belt have been given names."

Windows to the Universe-Asteroids:
http://www.windows.umich.edu/cgi-bin/tour.cgi?link=/our_solar_system/asteroids.html&br=graphic&sw=false&sn=4477&d=/our_solar_system&tour=&edu=elem

Picture from Online Self-Guided Lesson on Auroras



Taken from the space shuttle, this image shows the characteristic ring shape of an aurora.

Science Information Infrastructure's self-guided lesson on auroras:
http://www.exploratorium.edu/learning_studio/auroras/fromspace.html

A figure from the SHaring Aeronautics Projects Electronically (SHAPE) glider tutorial.

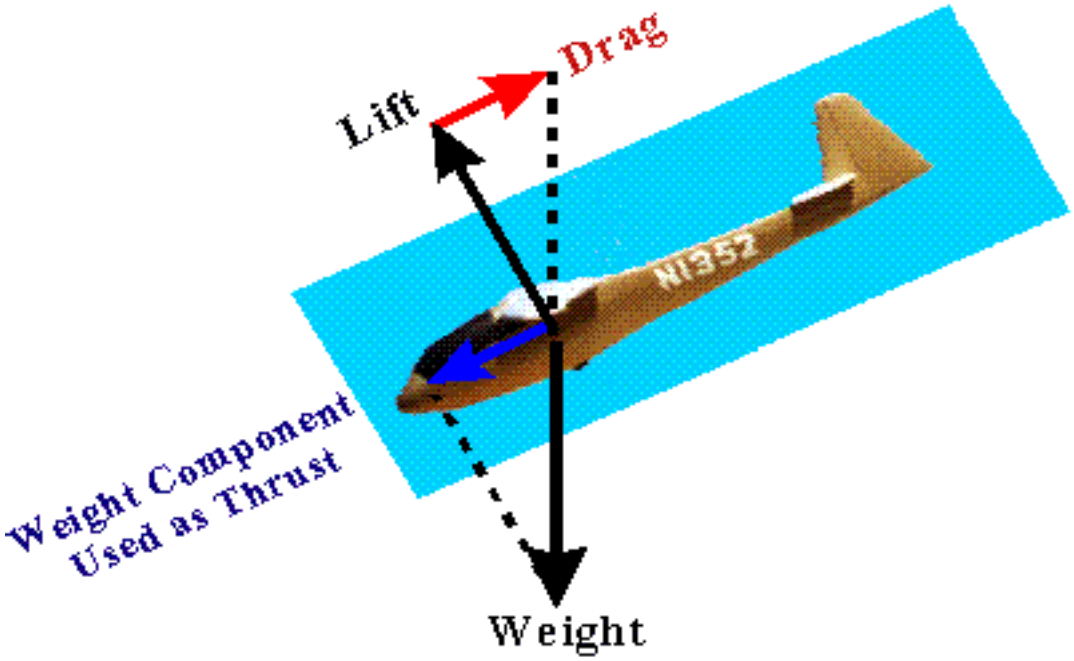
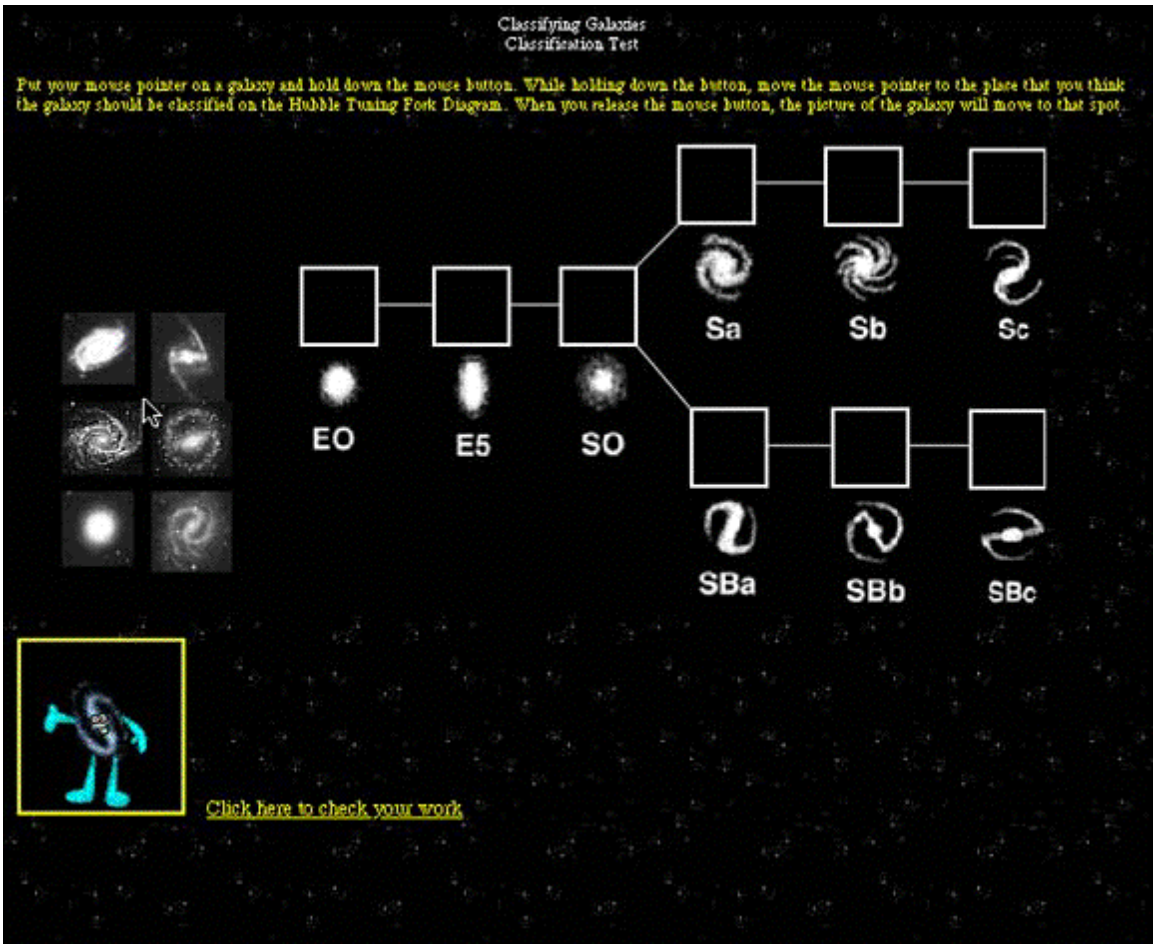


Figure 2: Glider, Steep Flight Path (High Speed)

Glider Flight Tutorial:
http://trc.dfrc.nasa.gov/shape/aovt/aeintro.htm
Several IITA projects teach about piloting and aviation.

Classifying Galaxies



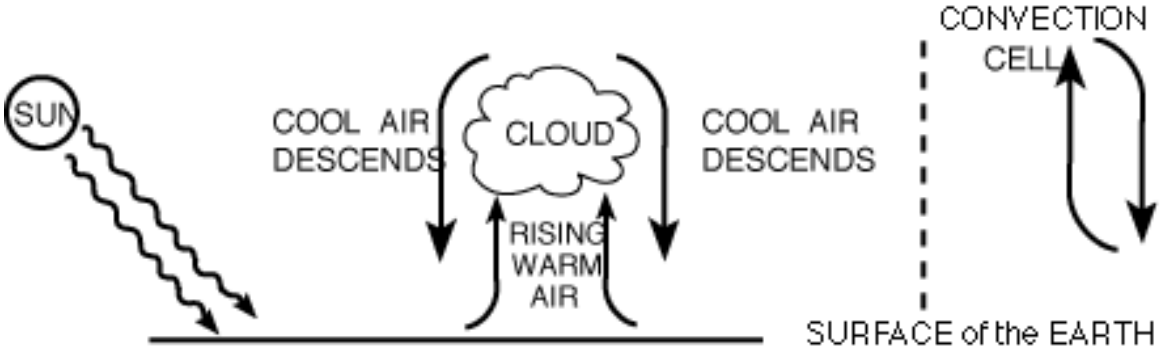
Classify galaxies using this Java applet provided by the Science Information Infrastructure (SII) project.

Science Information Infrastructure (SII) project::
http://www.cea.berkeley.edu/Education/SII/SEGway/

A Java-enabled browser is required to view this page.

Diagram from Live From the Hubble Space Telescope's Online Teacher's Guide:

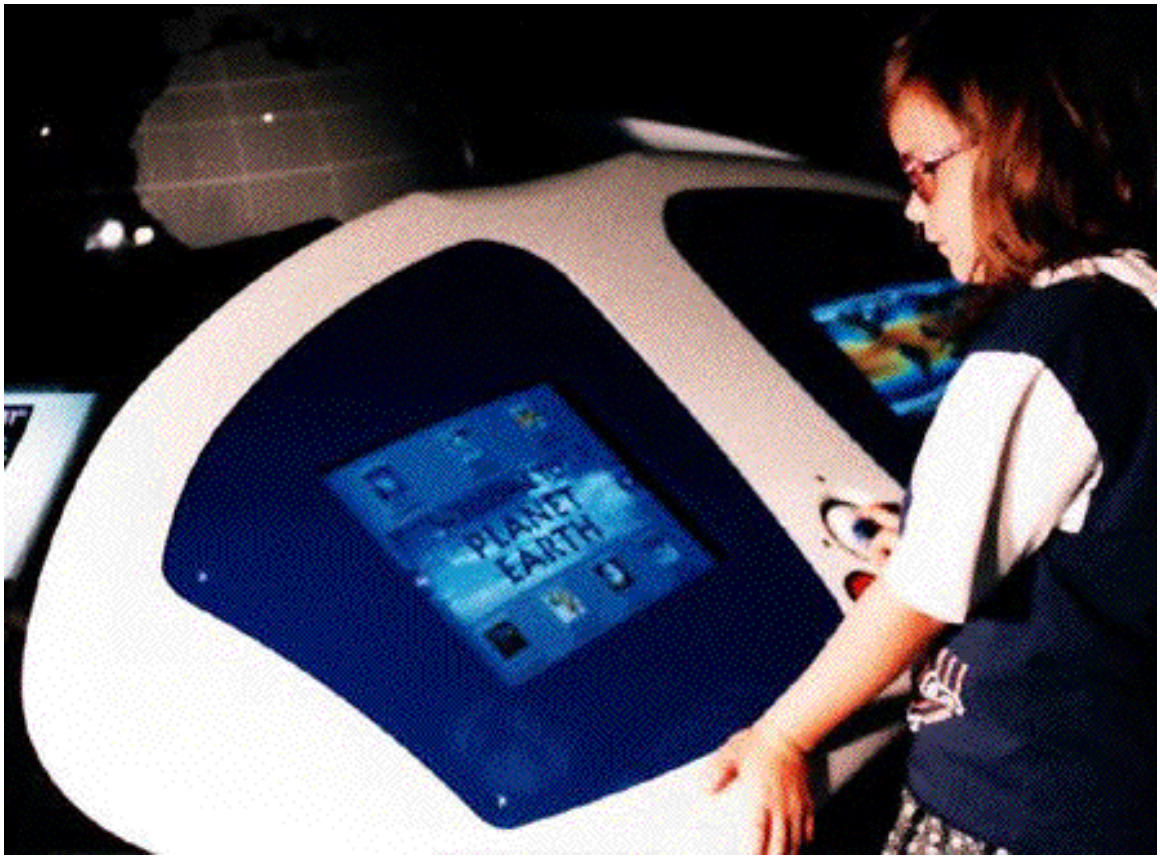
Planetary Storms/Observing Convection Currents



Showing how the Sun causes convective currents on the Earth and other planets.

Live from the Hubble Space Telescope Teacher's Guide:
http://quest.arc.nasa.gov/hst/tg/Activity_3.html#35

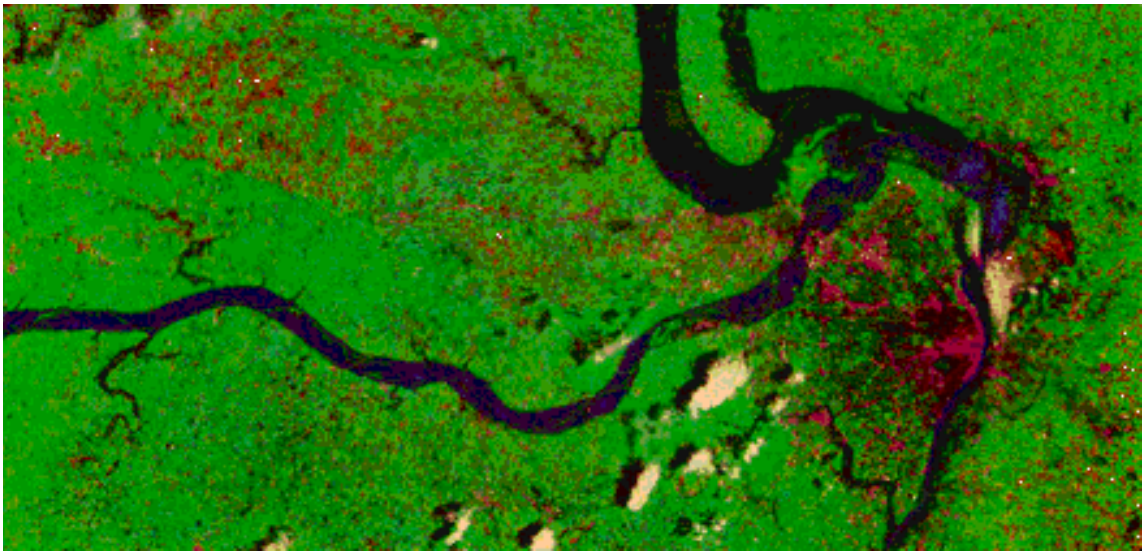
Creating the Public Connection



A child uses a kiosk developed by Rice University and the Houston Museum of Natural Science.

The Public Connection:
http://space.rice.edu/hmns/
http://spaceupdate.com/

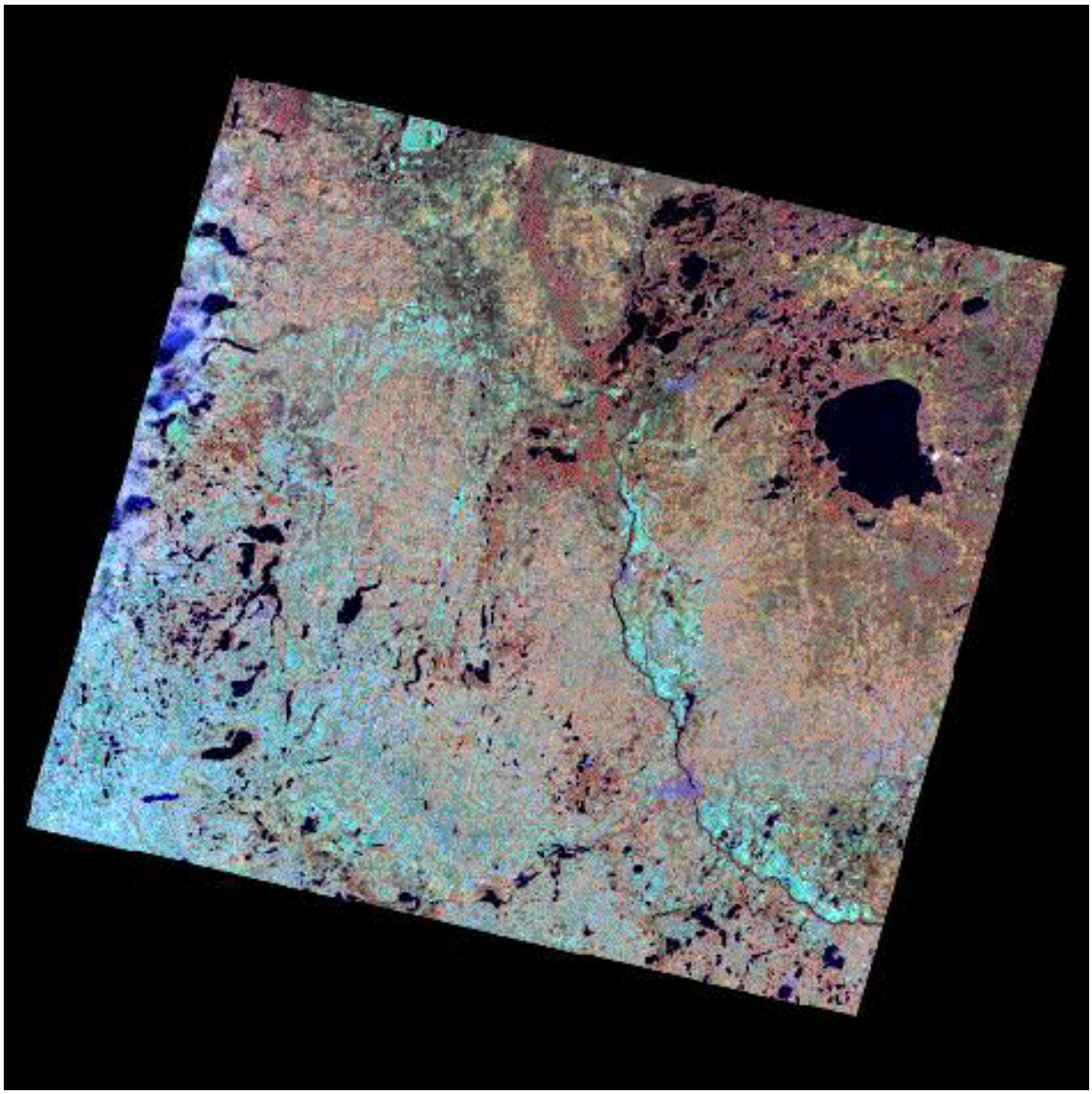
IITA emergency response projects deliver flood images to public service agencies.



This satellite image shows the Mississippi River flood in St. Louis during 1993.

Emergency and Crisis Management:
http://pearl.ias.unt.edu:9876/index0116.html

ForNet forest management server delivers Landsat and geographic information services to Minnesota state government agencies via the Internet.



Landsat Thematic Mapper image of northern Minnesota located using ForNet's ImageView service.

ForNet ImageView interface:
http://www.gis.umn.edu/fornet/ids/imageview/

A disabled pilot inspires handicapped youth to pursue careers in aeronautics.

An online interview with Mike Smith, Aero Haven Flight School.

PlaneMath:
http://www.planemath.com/activities/flightpath/flightpathcareer.html

Hurricane Fran

One of the top ten images of the year.
Featured in *Time* and *Life* magazines.

Public Use of Remote Sensing Data project at
NASA's Goddard Space Flight Center:
http://rsd.gsfc.nasa.gov/rsd/images/Fran.html

Education Outreach at several NASA centers actively instructs teachers in the use of the Internet.

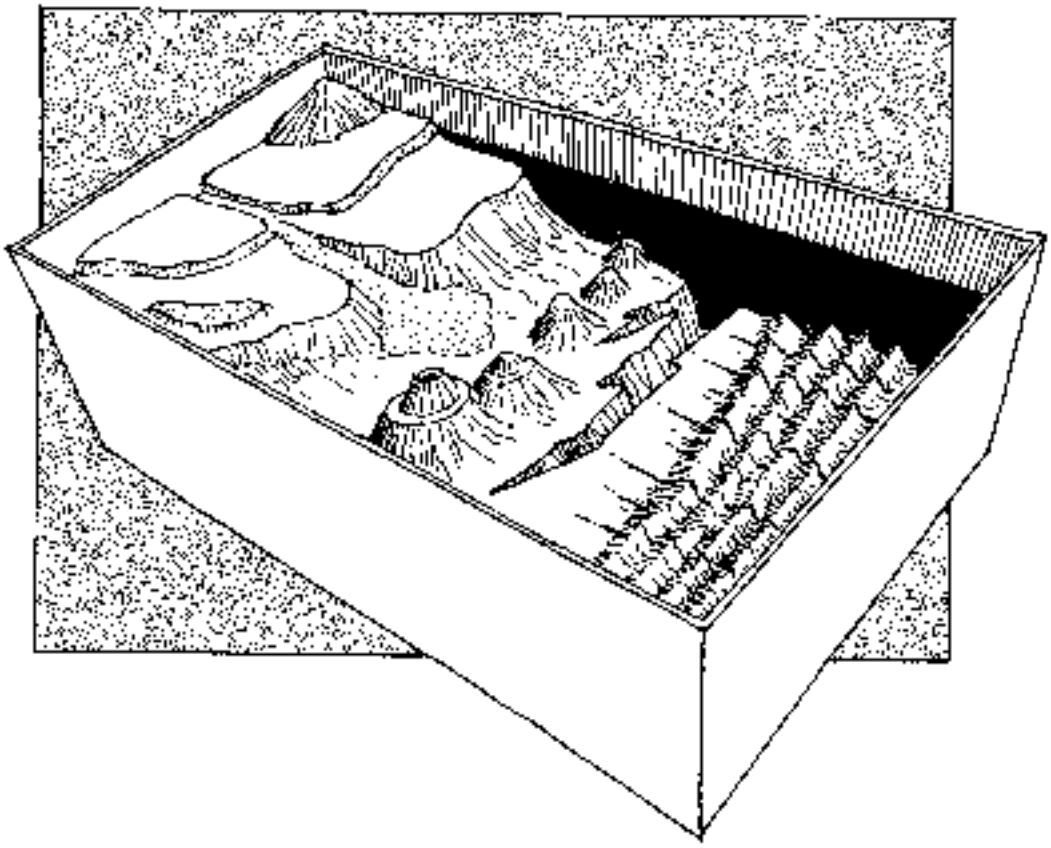
HorizonNet
Online Training Materials
Created by the NASA Langley IITA K-12 Program

NASA Ames Research Center K-12 Project:
http://quest.arc.nasa.gov/bring.html

NASA Langley Research Center K-12 Project:
http://k12unix.larc.nasa.gov/training/topiclist.html

NASA Lewis Research Center K-12 Project:
http://www.lerc.nasa.gov/WWW/K-12/CoE/COEmain.html

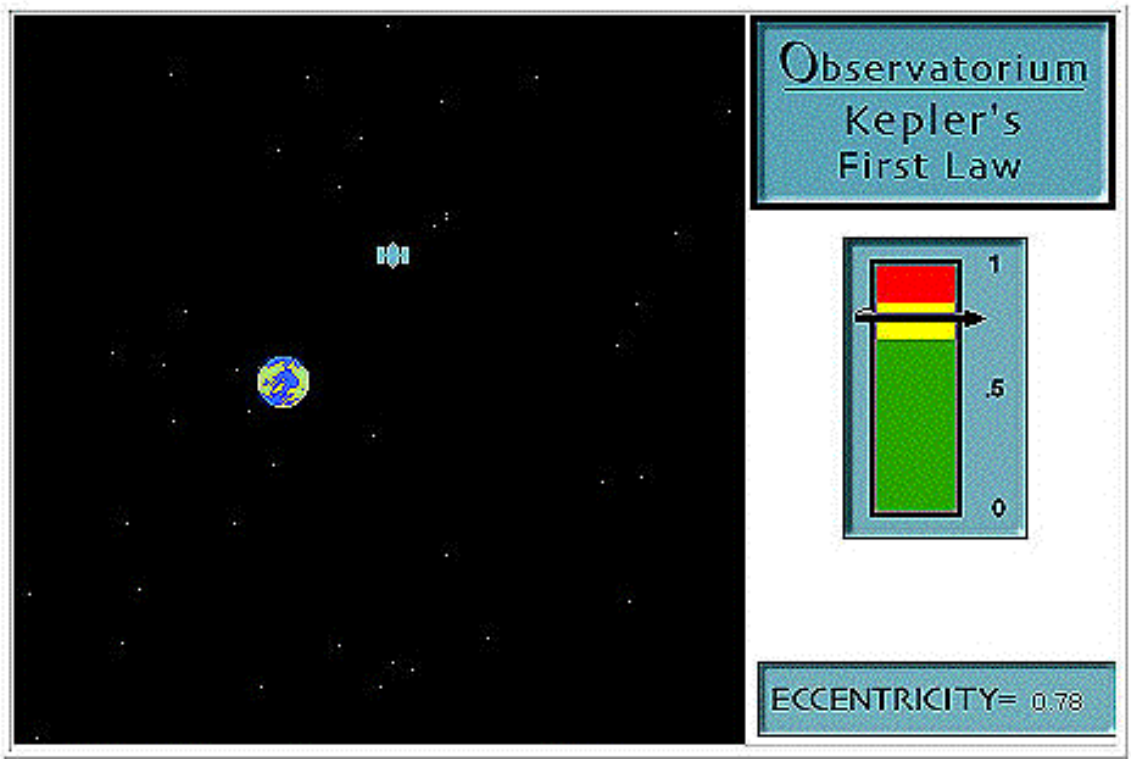
Online Learning Activity
Space Available: Gulf of Maine Aquarium Ocean Soundings



Model the ocean floor in a shoebox and take depth measurements.

Gulf of Maine Aquarium:
http://octopus.gma.org/surfing/ocean/soundings.html

Orbit simulators have been created, allowing online viewers control of a simulated orbiting satellite.

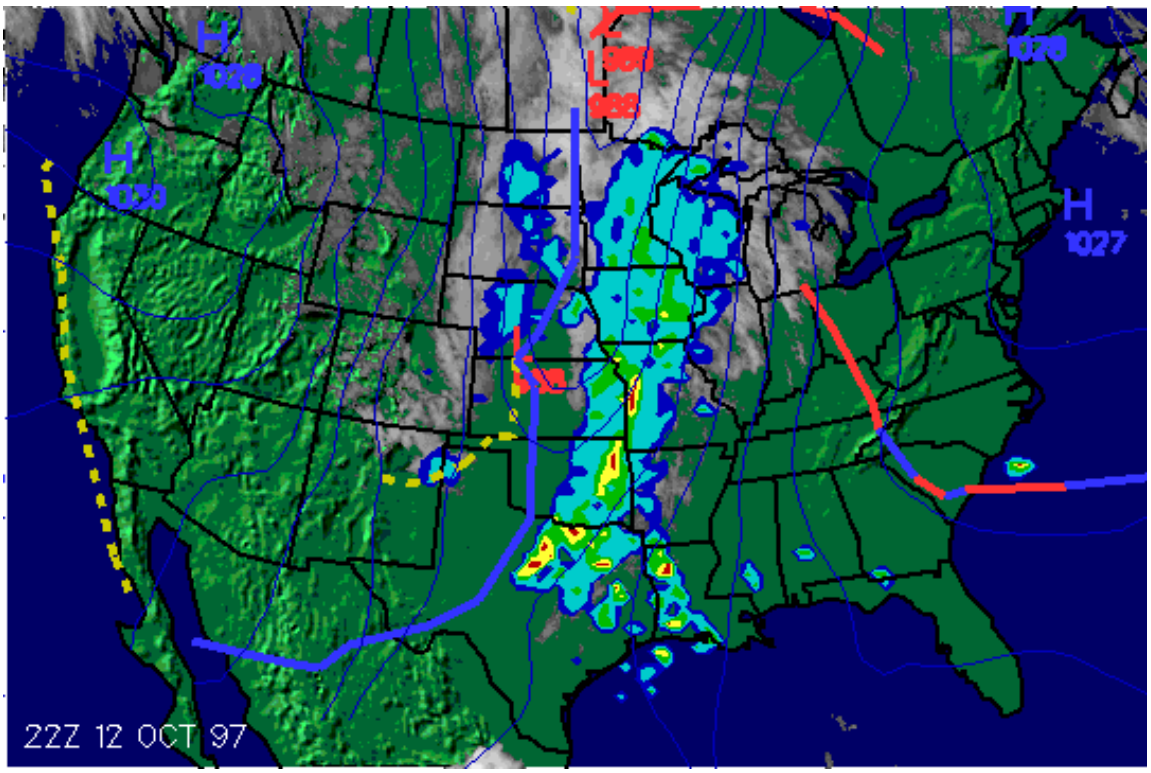


From Web simulation of Kepler's First Law.
This series of animations was created using Java.

NASA's Observatorium:
http://observe.ivv.nasa.gov/nasa/education/reference/orbits/orbit1.html

A Java-enabled browser is required to view this page.

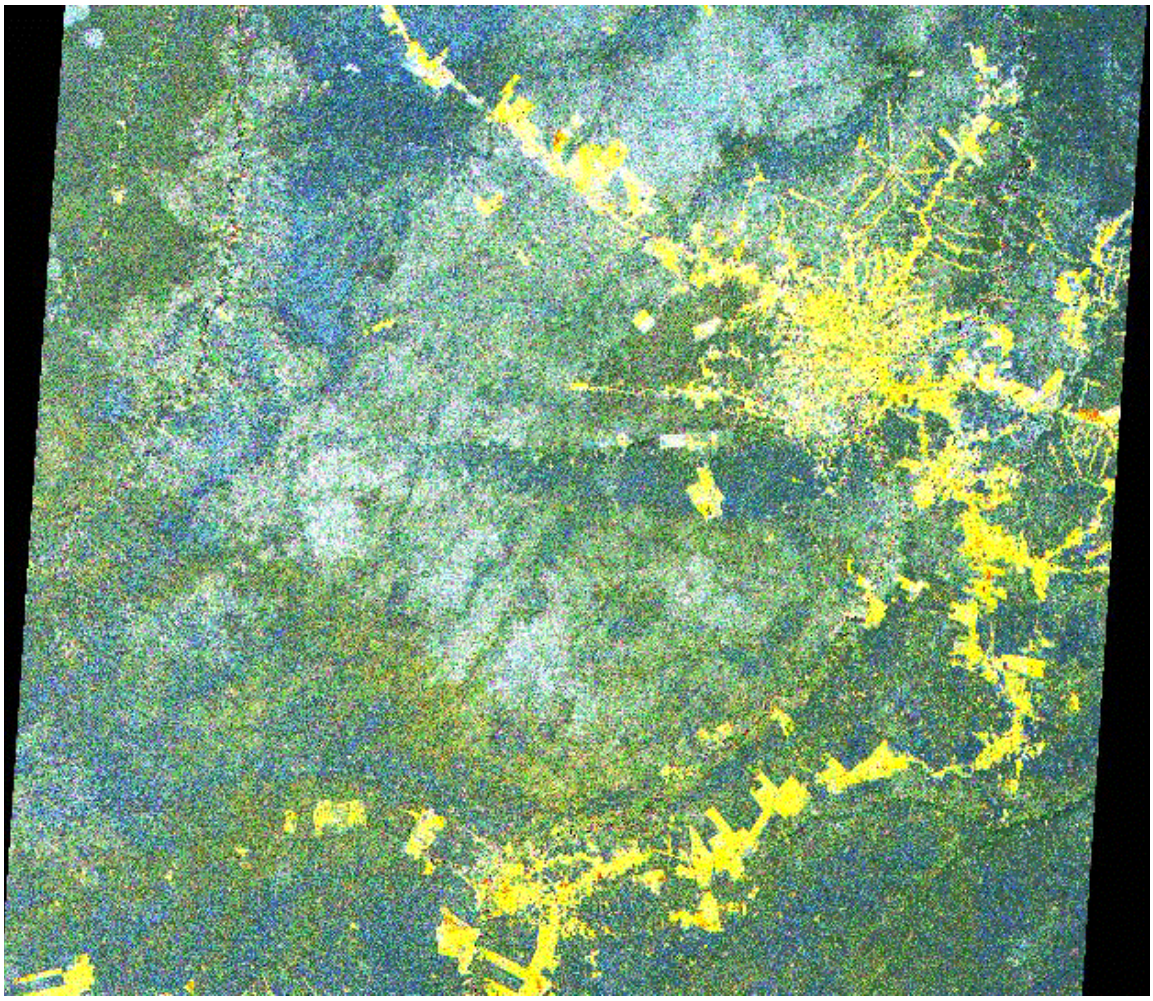
Rainfall map for October 12, 1997



The Athena project begins its online precipitation lesson with a map of the current day's rainfall.

Athena precipitation lesson:
http://athena.wednet.edu/curric/weather/ppt.html

Students are given an online lesson about environmental change.



Students examine a change detection product prepared from Landsat images of the Amazonian rain forest taken between 1986 and 1992.

From "Image Processing Activity 1:
Seeing Environmental Change"

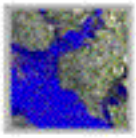
Exploring the Environment:
http://cotf.edu/ETE/scen/rainforest/imagep1.html

IITA Web site offers the public information on sources of image processing software.

NASA's OBSERVATORIUM

You Can Do Remote Sensing

Free Thematic Mapper Data Sets & Step-by-Step Instructions



Yes, I said free. We have seven-band, 512x512, thirty-meter resolution data sets from the Landsat Thematic Mapper and a step-by-step procedure for viewing and analyzing them using a freeware application that is available for both Macintosh and PC computers. Download the images and the software and you can be doing remote sensing today!

Sources of Remote Sensing Data

Remote sensing satellites have been collecting observations of the Earth and space for many years. There are several major NASA and other government archives of Earth and space data, as well as several commercial remote sensing firms that offer value-added products.

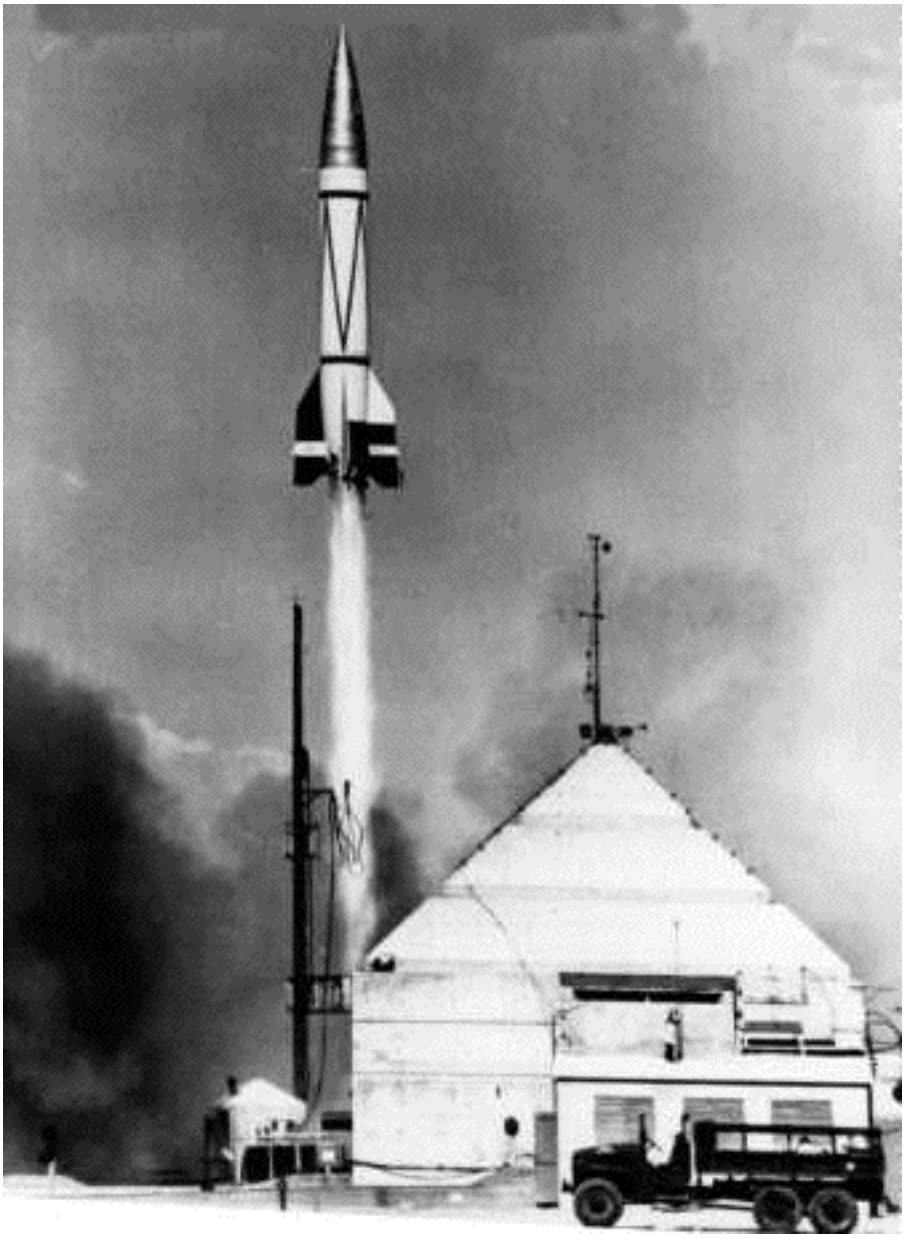
Sources of Remote Sensing Software

Remote sensing display and analysis software is now available for almost every type of computer system, including those found in homes and schools. We have included summaries of a few popular packages, both commercial and in the public domain, as well as links to where to obtain more information and the actual software.

From NASA's Observatorium: Tools & Data

NASA's Observatorium:
http://observe.ivv.nasa.gov/nasa/education/tools/tools.html

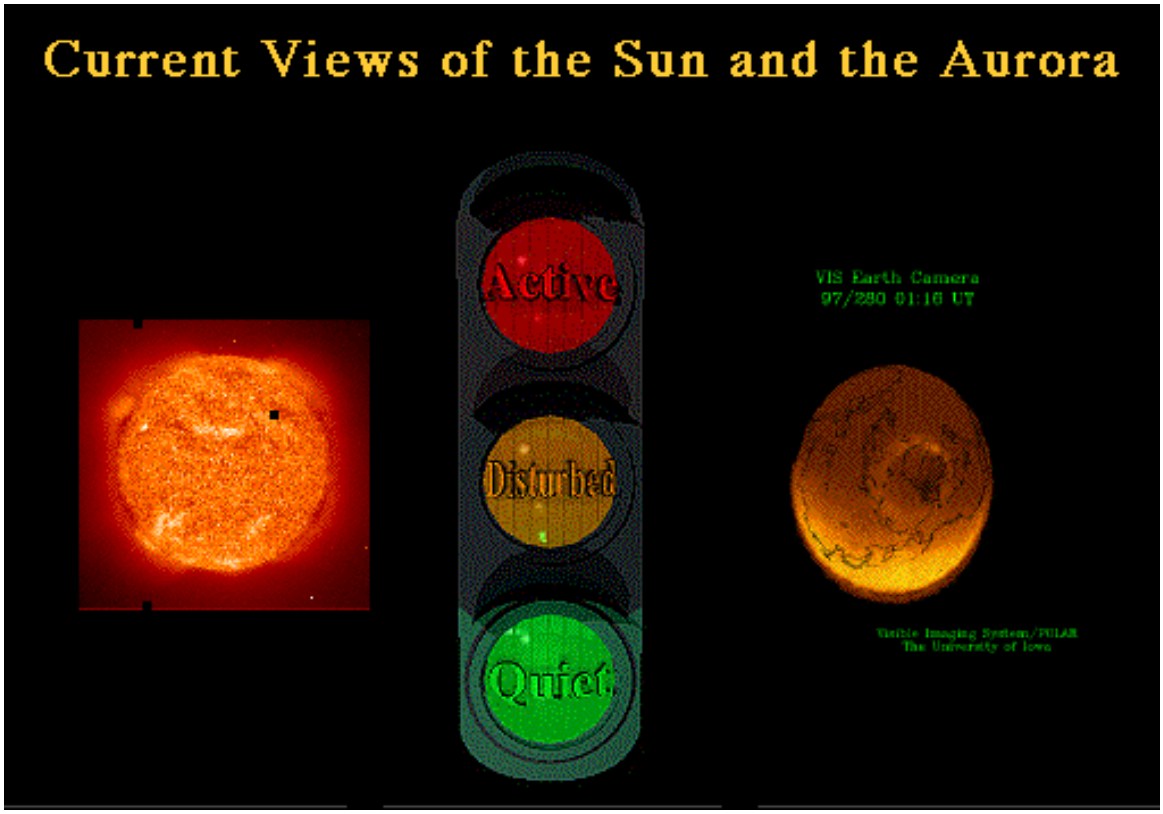
Information on the history of aeronautics delivered via the Internet.



AV-2 launch at White Sands Proving Grounds, NM.

Aeronautics Learning Laboratory for Science, Technology, and Research (ALLSTAR):
http://www.allstar.fiu.edu/aero/rock4.htm

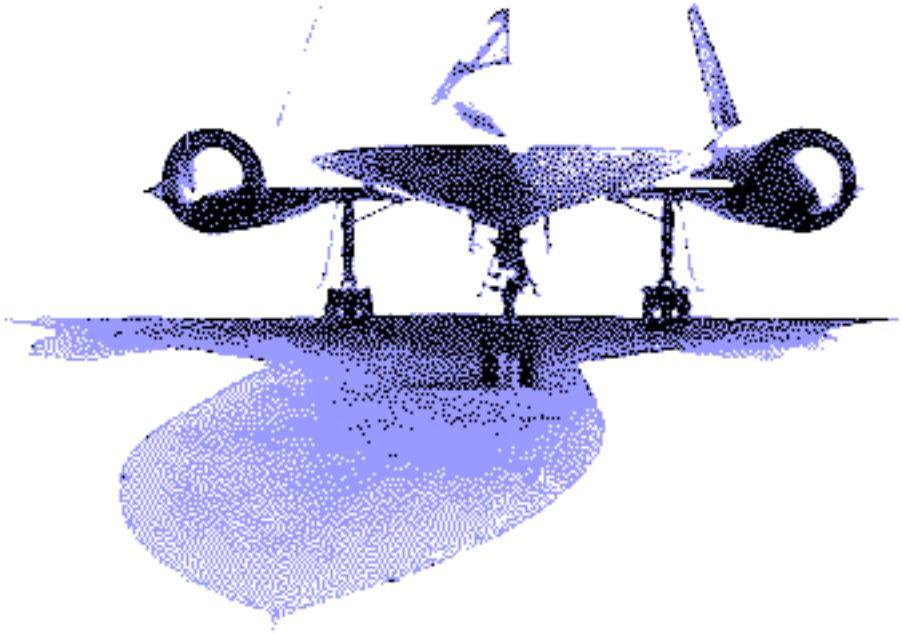
Space Weather Today



Space Weather Today is a joint project of Rice University's Public Connection, the University of Michigan's Windows to the Universe, and WRC-TV's WeatherNet4.

Space Weather Today:
http://www.windows.umich.edu:80/spaceweather/

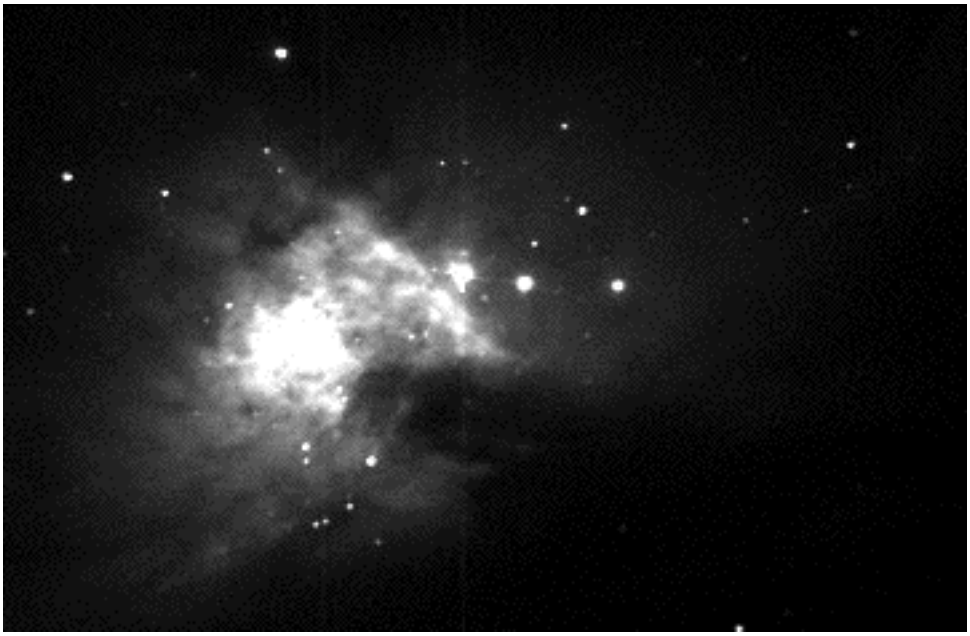
Opening Web page from an article on NASA's Observatorium: SR-71



SPEED IN THE SERVICE OF SCIENCE

NASA's Observatorium - SR-71:
http://observe.ivv.nasa.gov/nasa/aero/exhibits/sr-71/sr-71.html

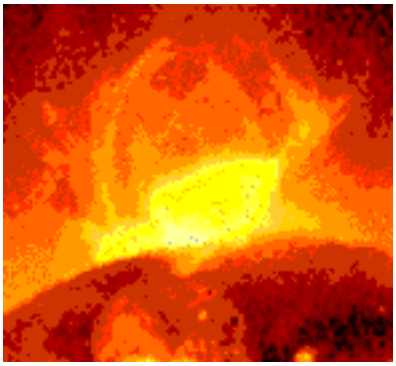
The Telescopes In Education project lets K-12 students dial up and remotely control the Mount Wilson Observatory's 24" f/16 Cassagrain telescope.



M42 - The Great Orion Nebula: Taken by Laura Badgor and Emmanuel Ramirez from the Elsinore Middle School, Lake Elsinore, California, on January 31, 1995.
40 sec. exposure.

Jet Propulsion Laboratory K-12 Project - Telescopes In Education:
http://tie.mtwilson.edu

X-ray image of the Sun taken by Japan's Yohkoh satellite on August 28, 1992.



Selected by NASA's Observatorium Web server as its "Observation of the Week," September 11, 1996.

Yohkoh Public Outreach Project:
http://www.space.lockheed.com/ypop/

NASA's Observatorium:
http://observe.ivv.nasa.gov/

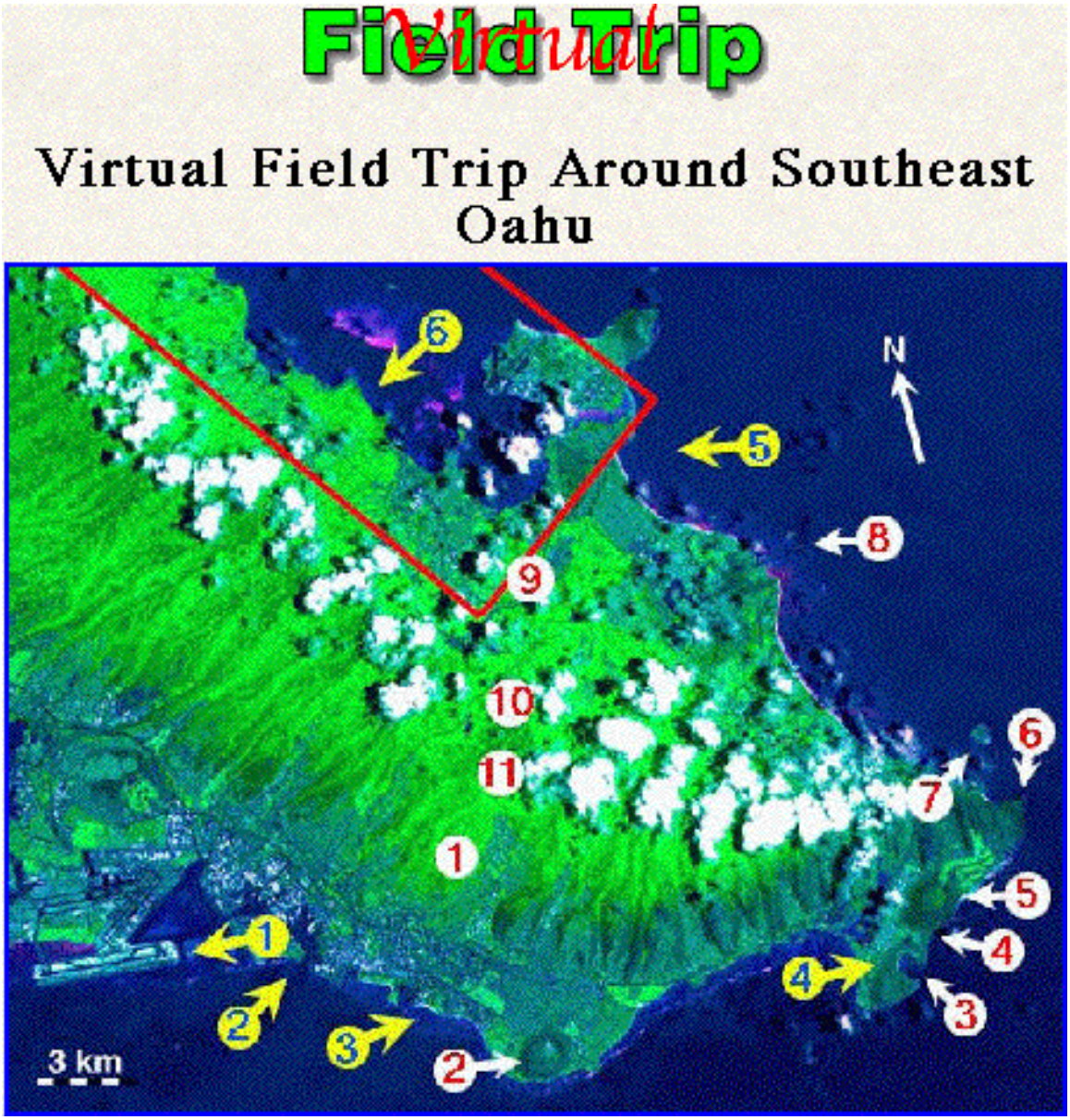
The Spirit of Inquiry

Everyday Classroom Tools

The Smithsonian Astrophysical Observatory is working with Massachusetts elementary schools to develop an inquiry-inspiring curriculum that will bring science and Internet activities into the everyday life of the elementary school classroom.

Everyday Classroom Tools:
http://hea-www.harvard.edu/ECT/

Delivering remote sensing imagery to the tourist industry.



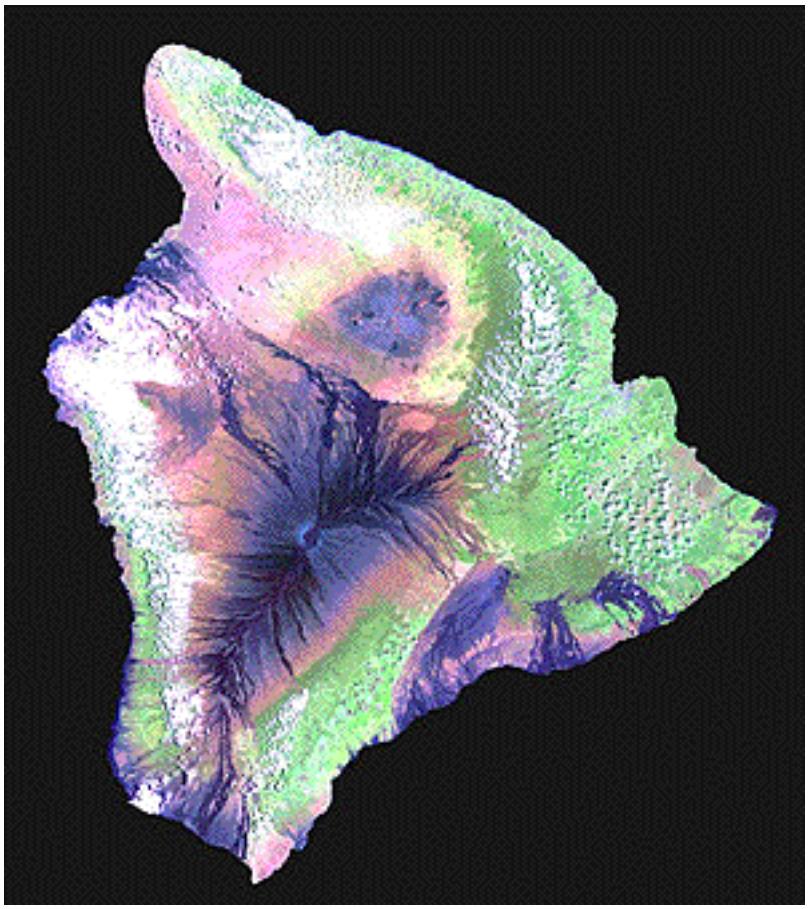
Virtually Hawaii launches one of its many online Virtual Tours of Hawaii.

Virtually Hawaii:
http://hawaii.ivv.nasa.gov/space/hawaii/vfts/oahu/oahu_se/oahu.se.vft.html
http://satftp.soest.hawiii.edu/space/hawaii/vfts/oahu/oahu_se/oahu.se.vft.html

Hawaii from space.

Virtually Hawaii:
http://hawaii.ivv.nasa.gov/
http://satftp.soest.hawiii.edu/space/hawaii/index_orig.html

A Landsat Thematic Mapper image of the Big Island.

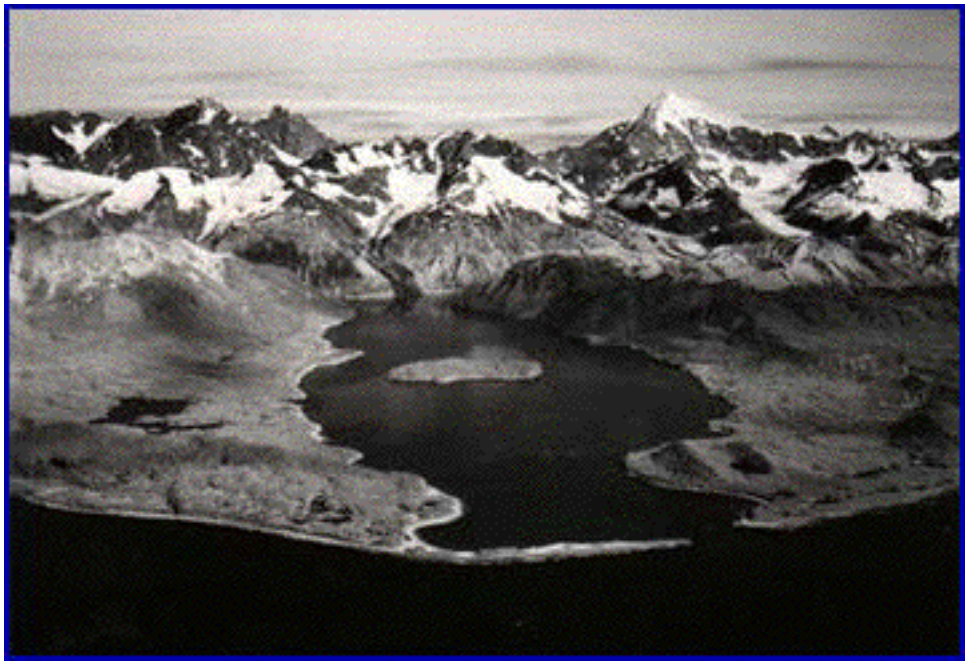


Virtually Hawaii:
http://hawaii.ivv.nasa.gov/
http://satftp.soest.hawiii.edu/space/hawaii/index_orig.html

Aerial view of SE Oahu.

Virtually Hawaii:
http://hawaii.ivv.nasa.gov/
http://satftp.soest.hawiii.edu/space/hawaii/index_orig.html

Web page excerpt from NASA's Observatorium: Tsunami - The Big Wave



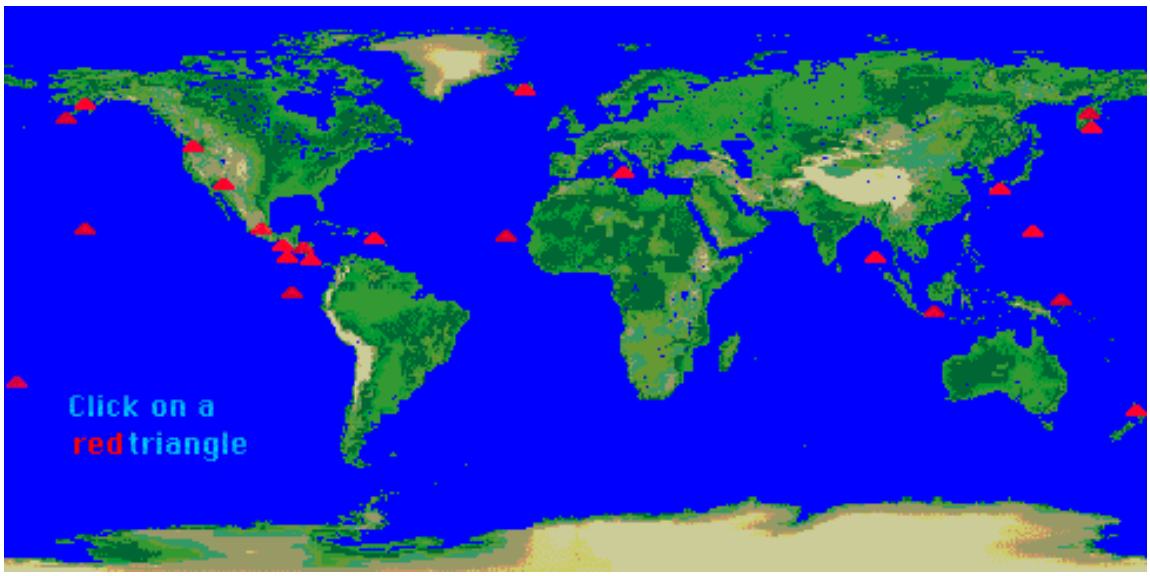
The Aleutian Islands in Alaska. It was here that an earthquake of 7.8 magnitude triggered an ocean-wide tsunami.

"April Fools' Day 1946. A day for tricks and fun everywhere...everywhere but Hilo, Hawaii, that is. It was 7:00 a.m. and as the fishermen were getting the last of their early morning catch, the sea decided to play a trick on them. Suddenly the ocean rushed out, leaving fish and boats stranded on bare sand. The fishermen, quite aware of the impending danger, rushed to shore to warn the town of the approaching disaster.

"Within minutes a wave that had traveled 2,500 miles from the Aleutian Islands in Alaska came crashing into Hilo. It killed one hundred fifty-nine people and caused millions of dollars in damages. The wave that destroyed Hilo is one of the most powerful and most feared natural disasters of all: the tsunami!"

NASA's Observatorium - Tsunami:
http://observe.ivv.nasa.gov/nasa/exhibits/tsunami/tsun_start.html

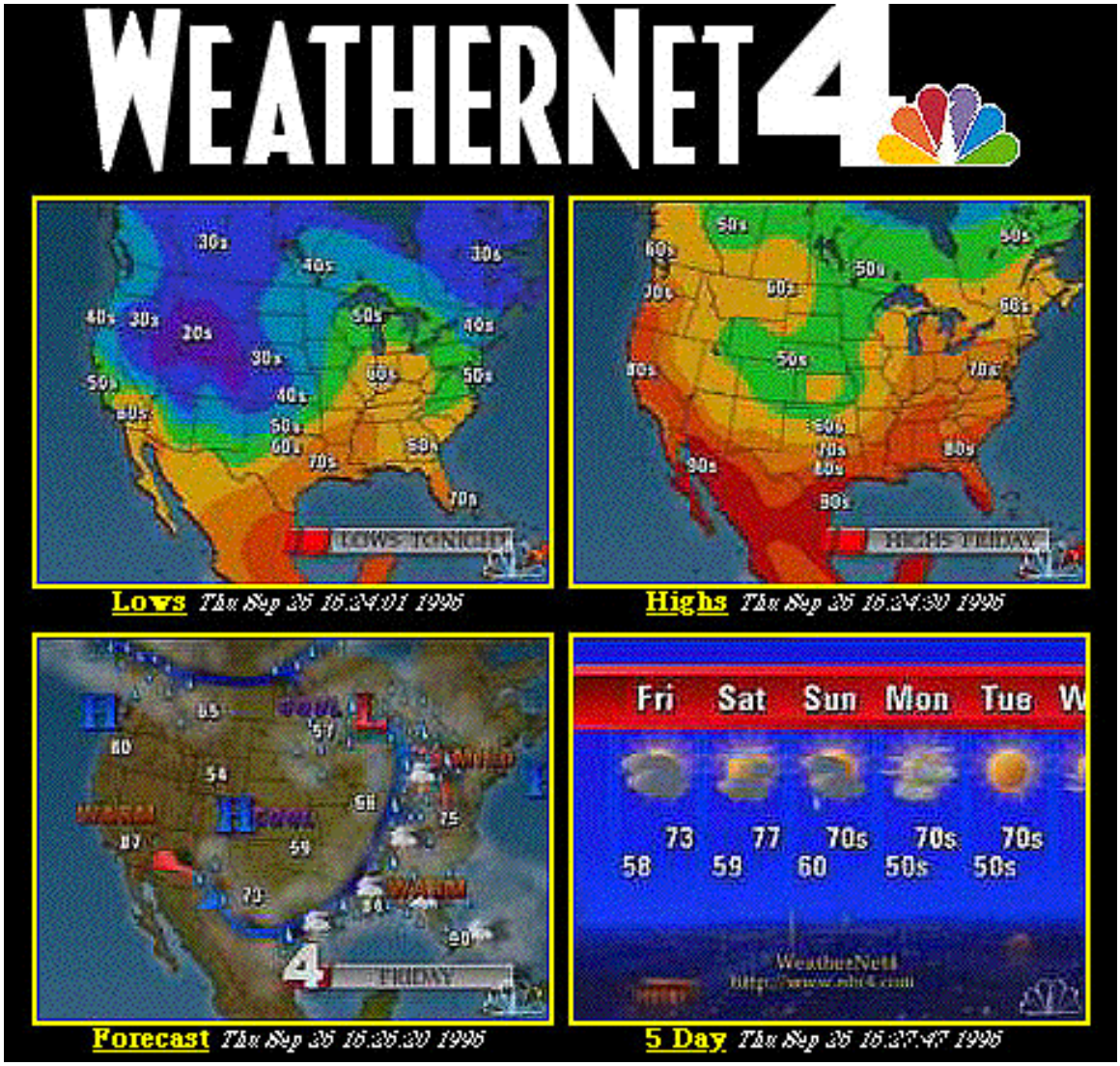
From VolcanoWorld's online page "What's Erupting Now"



Recent eruptions, September 29, 1997.

VolcanoWorld:
http://volcano.und.nodak.edu/vwdocs/current_volcs/current.html

Delivering weather images to the public.



WRC-TV in Washington, DC, brings weather information to the public via the Internet.

WeatherNet4:
http://wxnet4.nbc4.com/showForecast.html

Interactive satellite image from WeatherNet4.

WRC-TV in Washington, DC, brings weather information to the public via the Internet.

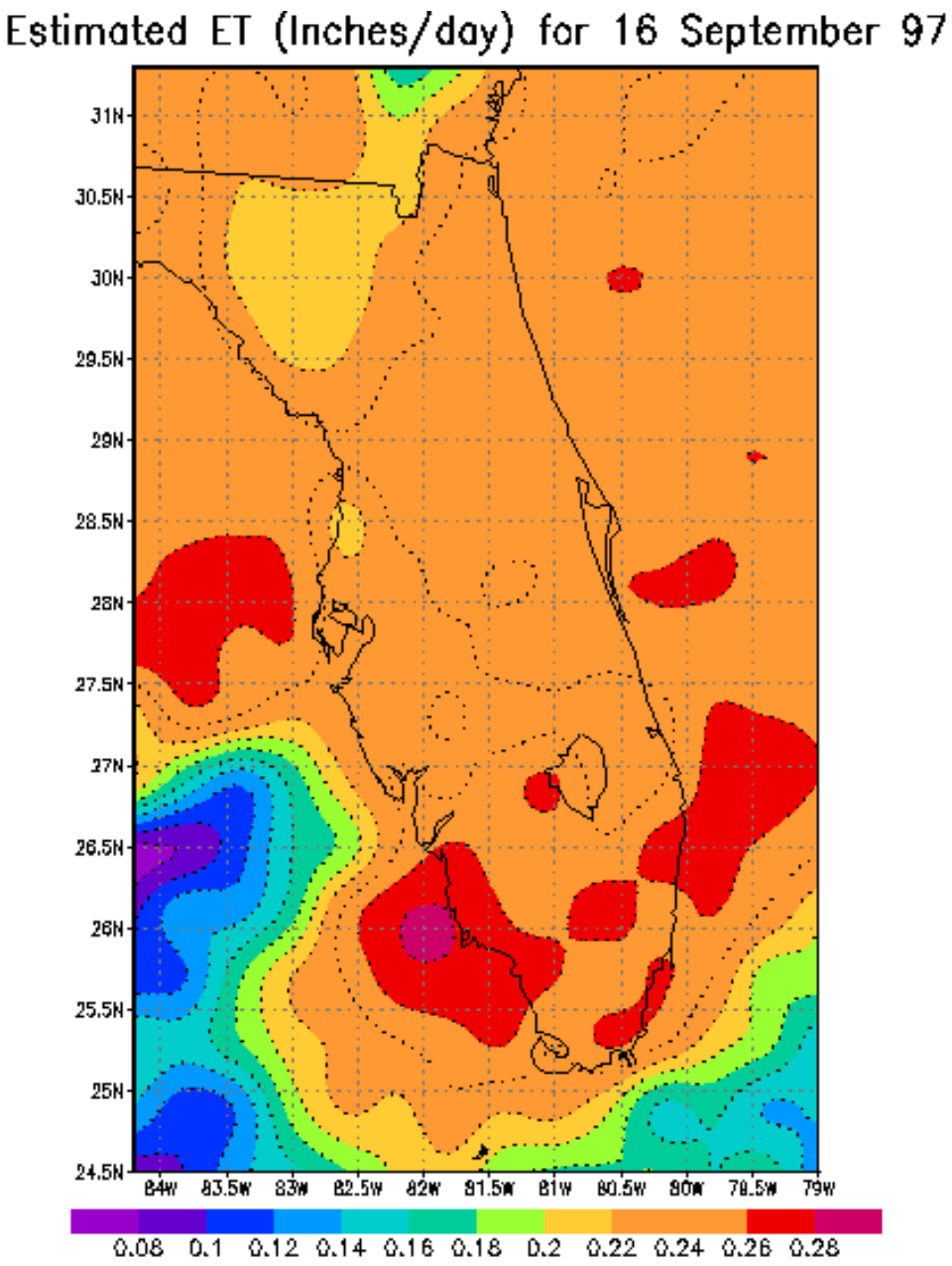
WeatherNet4:
http://wxnet4.nbc4.com/satelliteimages.html

Wonderful Sunrise

Photo from WeatherNet4 Best of City-Cam Archive.

WeatherNet4 Best of City-Cam Archive:
http://wxnet4.nbc4.com/cgi-bin/imgArchive/Webdriver?MIval=best_of

Delivering agricultural irrigation information to farmers.



Evaporation in Florida, September 16, 1997. Prepared from GOES satellite imagery.

Timely Satellite Data for Agricultural Management (TiSDat) -- Irrigation Manangement:
http://bob.soils.wisc.edu/tisdat/et.html

People can zoom from a map down to a one-meter resolution view of their neighborhoods.

San Leandro, San Francisco Bay.

Bay Area Digital GeoResource (BADGER) project:
http://badger.parl.com/